



UNIVERSAL ROBOTS



Service Manual

Revision UR5_en_3.0.2

Robot:

UR5 with CB3-controller

valid from robot s/n 2014350001

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1. General information

1.1 Purpose

The main purpose of this manual is to help the user safely perform service related operations and troubleshooting.

Universal Robots industrial robots are designed using high quality components designed for long lifetime. However any improper use of robot can potentially cause failures on the robot. For example, the robot may have been overloaded on an overrun or it may have been dropped on the floor when relocating or have run with a load not recommended by Universal Robots. Any improper use of the robot will invalidate the guarantee.

Universal Robots recommends that you do not attempt repair, adjustment or other intervention in the mechanical or electrical systems of the robot unless a problem has arisen. Any unauthorized intervention will invalidate the guarantee. Service related operations and troubleshooting should only be performed by qualified personnel

Before performing service related operations, always make sure to stop the robot program and disconnect supply to any potential dangerous tool attached on the robot arm and in the work cell.

In the event of a defect, Universal Robots recommends ordering new parts from the Universal Robot distributor from where the robot has been purchased.

Alternatively, you can order parts from your nearest distributor, whose details you can obtain from Universal Robots official website at www.universal-robots.com

1.2 Company details

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1.3 Disclaimer

The information contained herein is the property of Universal Robots A/S and shall not be reproduced in whole or in part without prior written approval of Universal Robots A/S. The information herein is subject to change without notice and should not be construed as a commitment by Universal Robots A/S. This Manual is periodically reviewed and revised.

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2. Preventive Maintenance

2.1 Controller



2.1.1 Inspection plan, Safety Functions

- At least once in a year, the correct functioning of all safety functions should be tested.

2.1.2 Visual inspection

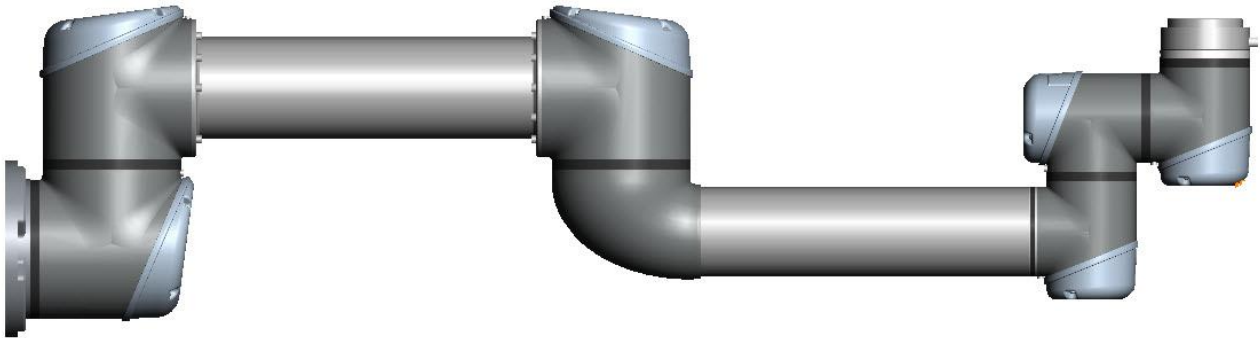
- Disconnect power cable from controller.
- Open cabinet door.
- Check connectors are properly inserted on printed circuit boards.
- Check for any dirt/dust inside of controller.
- If any dirt/dust is present:
 - » gently use vacuum cleaning for removing particles.

2.1.3 Cleaning and replacement of filters

- Controller box contains two filters, one on each side of controller.
- Remove filters from controller box and clean them thoroughly using compressed air.
 - » Replace filters if necessary.



2.2 Robot arm



2.2.1 Visual inspection

- Move robot arm to HOME position (if possible).
- Turn off and disconnect power cable from controller.
- Inspect cable between controller and robot arm for any damages.
- Inspect flat rings for wear and damages.
 - » replace flat rings if worn out or damaged.
- Inspect blue lids on all joints for any cracks or damages.
 - » replace blue lids if cracked or damaged.
- Inspect that screws for blue lids are in place and properly tightened.
 - » Replace screws, tighten properly if necessary.



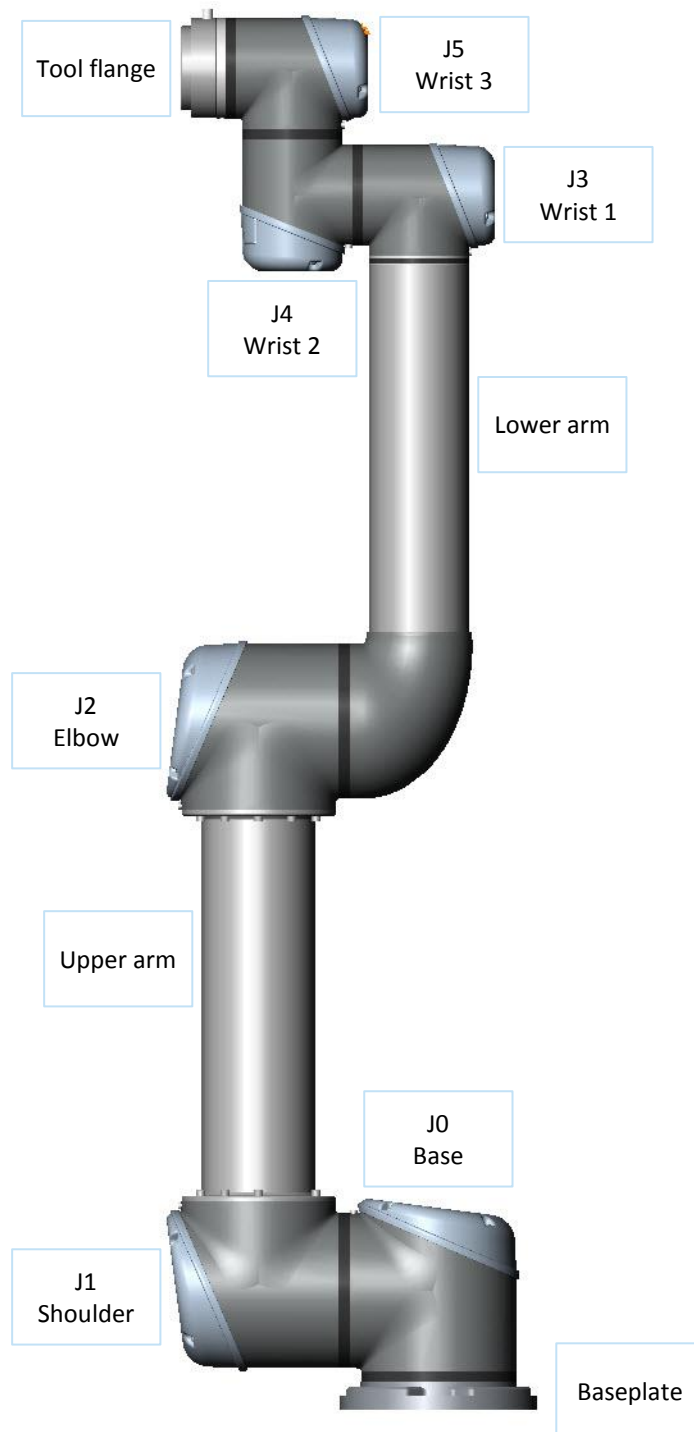
Correct torque value for screws on blue lids are 0.5Nm

If any damages are observed on a robot within the warranty period, contact the distributor from where the robot has been purchased.

3. Service and Replacement of parts

3.1 Robot arm

3.1.1 Robot arm configuration



3.1.2 Brake release

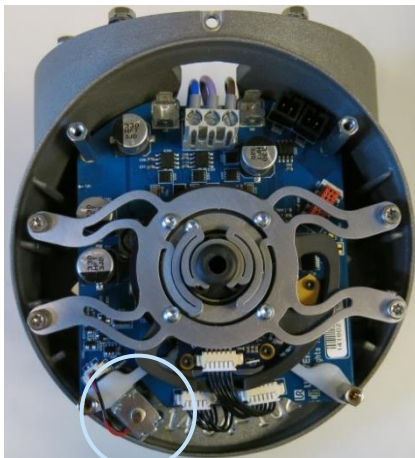
If required, the brake on a joint can be released without power connected.

IMPORTANT NOTICE:

- Before releasing a brake it is extremely important to dismount any dangerous tooling for avoiding any hazardous situations.
- If releasing the brake on Base joint, Shoulder joint or Elbow joint, it is important to make proper mechanical support prior to releasing the brake.
- Always make sure no personnel are located under the arm when releasing the brake.
- Do not move the joint more than necessary, absolute max. is 180 degrees in order for the robot to find its original physical position.

Procedure for releasing the joint

- Shut down Controller.
- Remove blue lid on joint.
- Push pin brake down for releasing, joint can then be rotated.



Brake on Base, Shoulder and Elbow joints,



and on all Wrist joints

- Make sure to mount blue lid properly on joint before turning on Controller.

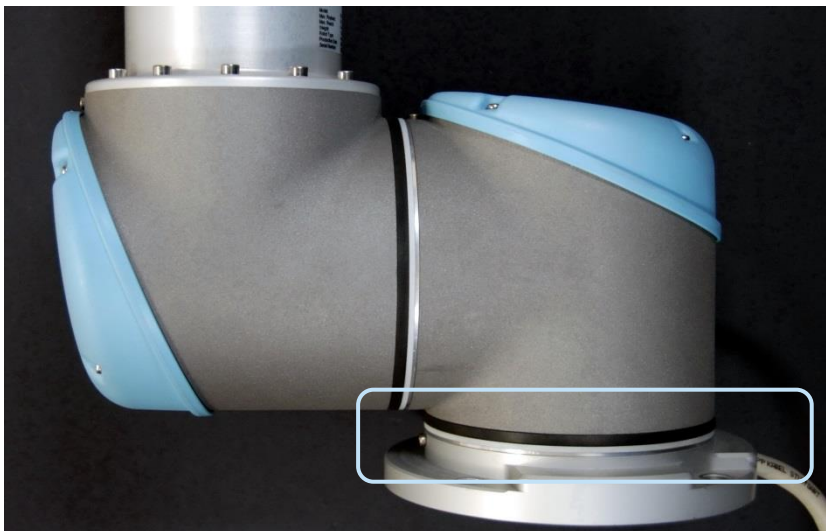
3.1.3 Replacement of base plate

How to replace base plate

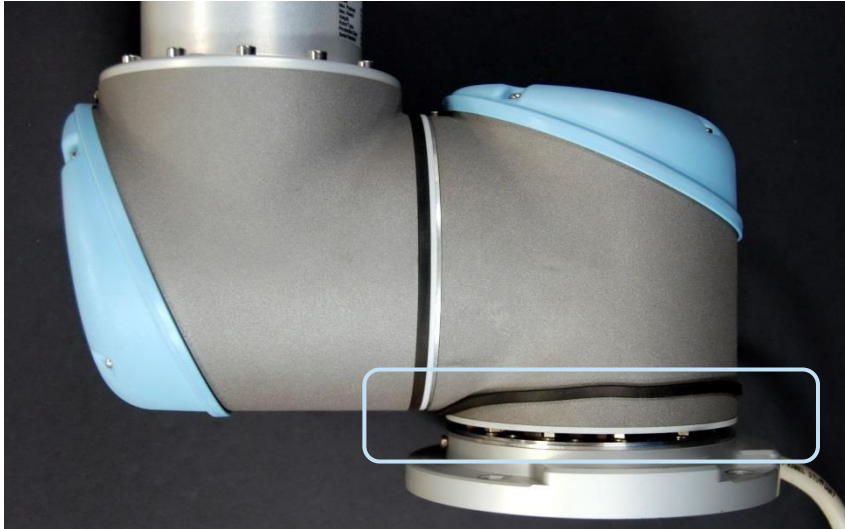
- Move robot to a comfortable position for replacing the base. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- Remove grease plug.



- Gently remove black flexible flat ring with a tiny screwdriver or similar tool and twist it around the joint housing.



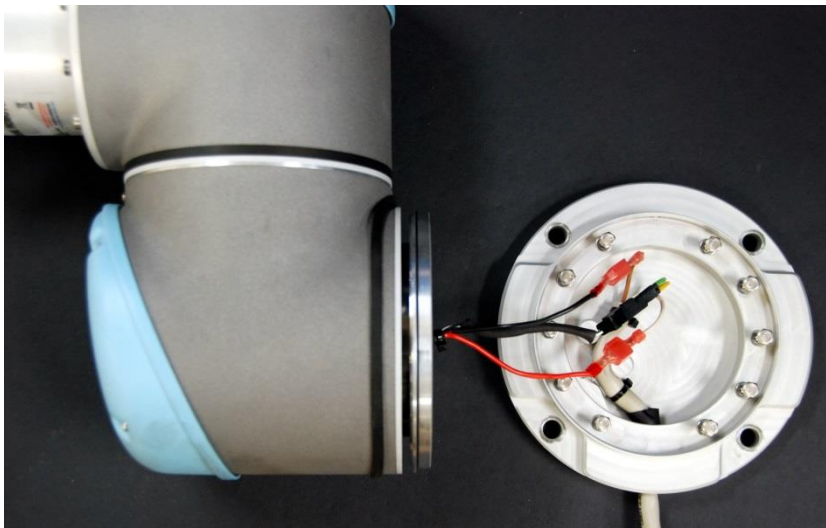
- Slide the grey Teflon ring apart.
10 screws become visible, 5 on each side of joint.
Untighten gently the screw with a 7 mm. open-ended spanner about two full rounds,
approximately 3 mm. for each screw.



- Pull the base plate and Base joint apart and gently twist the two parts in opposite directions around 10 mm. until a mechanical stop is met (holes are keyhole-type).

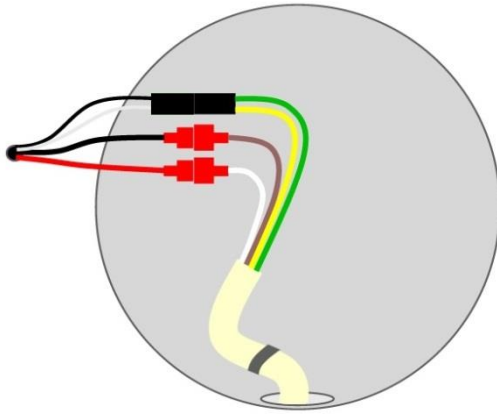


- Pull away the base plate from Base joint.

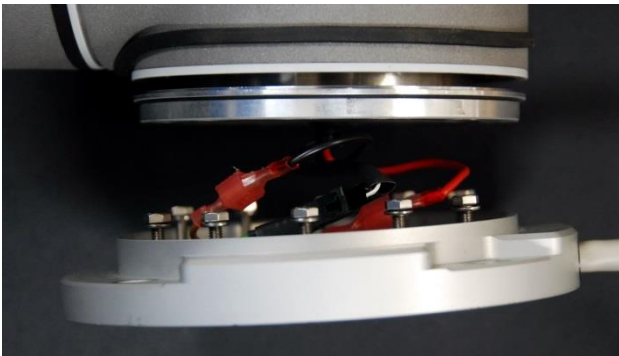


- Disconnect wires between base plate and Base joint.
1 x red wire = 48V DC
1 x black wire = GND
Black connector = bus cable (NB: polarized)

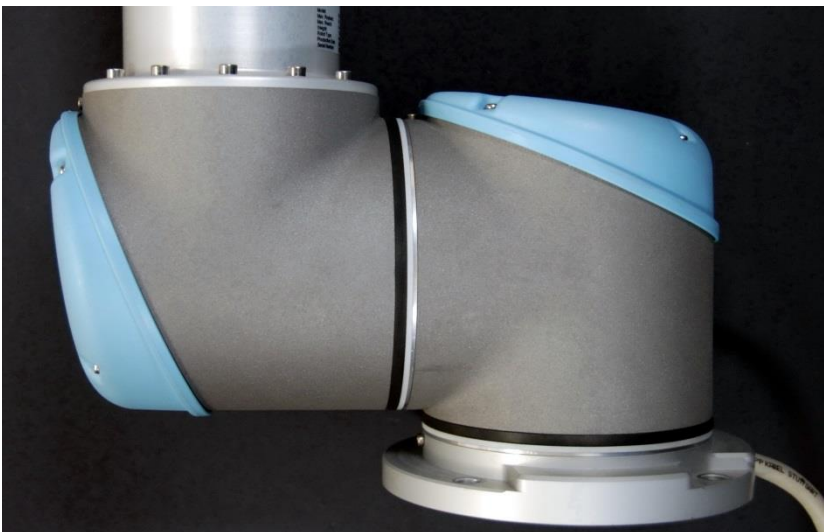
- Replace base plate and reconnect wires according to illustration:



- Gently insert base plate with screws and washers into the Base joint.



- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting the base plate and Base joint in opposite directions until a mechanical stop is met.
- Tighten the 10 screws lightly, then tighten in cross order with 3.0Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.



- Mount the grease plug and tighten with 0.8Nm.

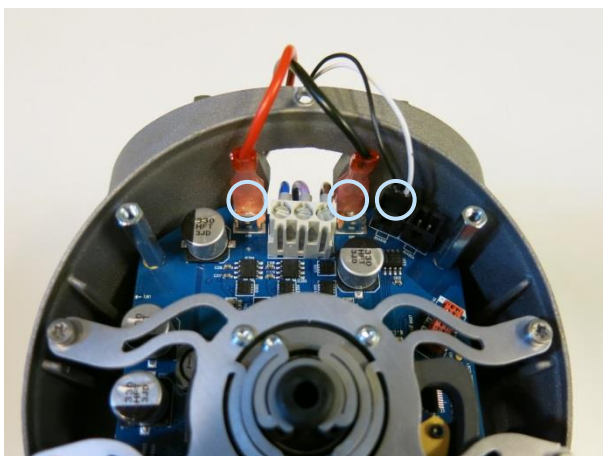
3.1.4 Replacement of Base joint

How to replace Base joint

- Move robot to a comfortable position for replacing the joint. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- For separating base plate from Base joint, consult chapter [3.1.3 Replacement of base plate](#).
- Remove blue lid on Base joint.

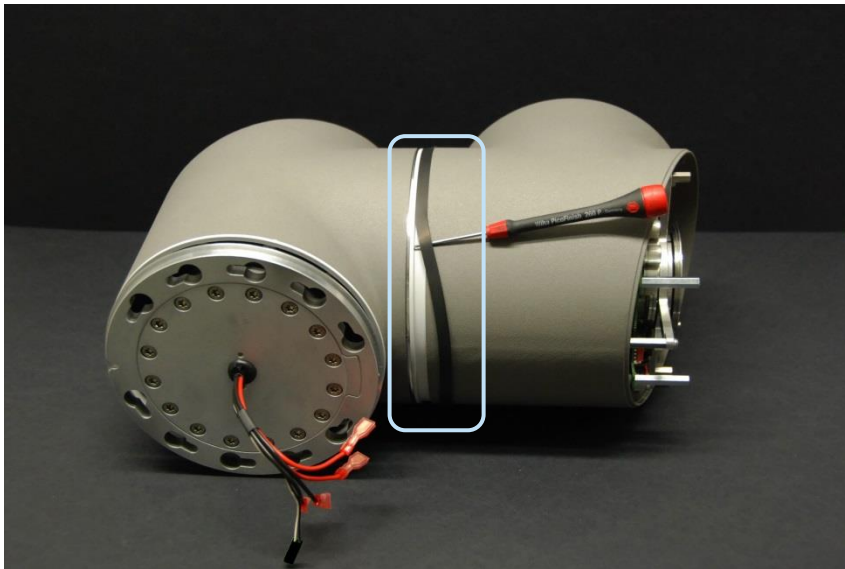


- Disconnect wires between Base joint and Shoulder joint
 - 1 x red wire = 48V DC
 - 1 x black wire = GND
 - Black connector = bus cable

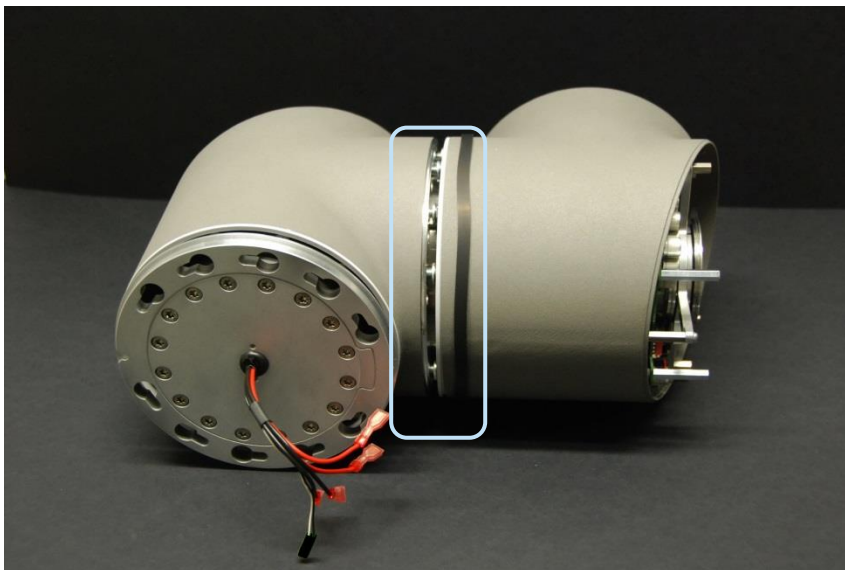


- Remove grease plug at Shoulder joint.

- Gently remove black flexible flat ring between Base and Shoulder with a tiny screwdriver or similar tool and twist it around the joint housing.



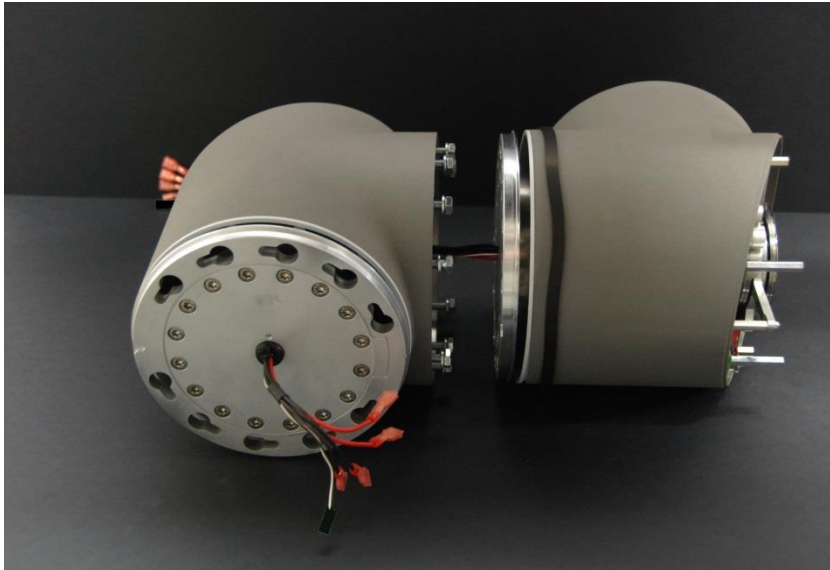
- Slide the grey Teflon ring apart.
10 screws become visible, 5 on each side of joint.
Untighten gently the screw with a 7 mm. open-ended spanner about two full rounds, approximately 3 mm. for each screw.



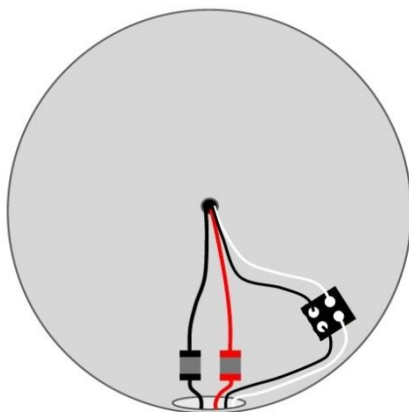
- Pull the Base joint and Shoulder joint apart and gently twist the two parts in opposite directions around 10 mm. until a mechanical stop is met (holes are keyhole-type).



- Pull away the Base joint from Shoulder joint.



- Replace Base joint and gently insert Base joint with screws and washers into the Shoulder joint.
- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting the Base joint and Shoulder joint in opposite directions until a mechanical stop is met.
- Tighten the 10 screws lightly, then tighten in cross order with 3.0Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
- Mount the grease plug and tighten with 0.8Nm.
- Reconnect connectors as illustrated.



- Mount blue lid on Base joint and tighten with 0.5Nm.
- Proceed to chapter [3.1.11 Joint calibration](#) for calibrating the joint.

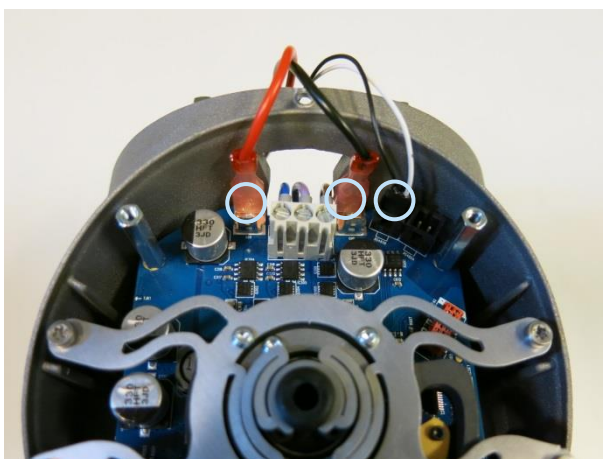
3.1.5 Replacement of Shoulder joint

How to replace Shoulder joint

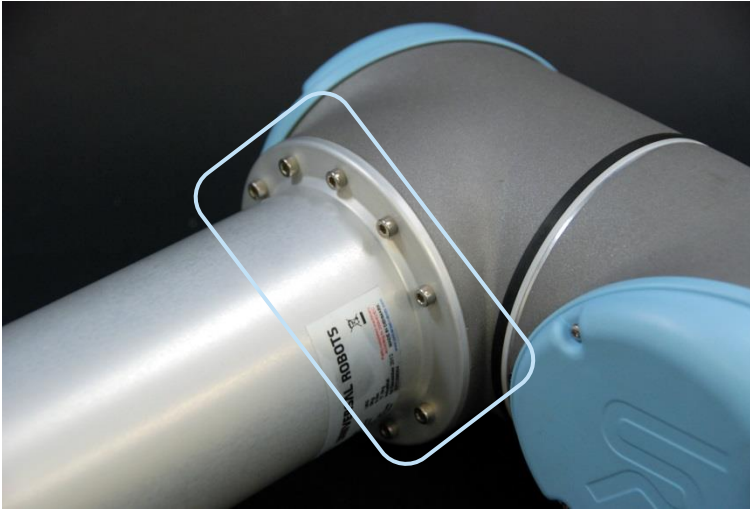
- Move robot to a comfortable position for replacing the joint. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- For separating Base joint from Shoulder joint, consult chapter [3.1.4 Replacement of Base joint](#).
- Remove blue lid on Shoulder joint.



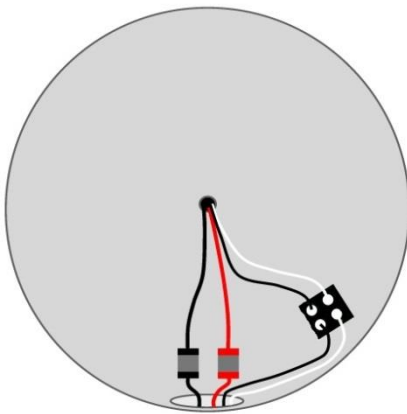
- Disconnect wires between Shoulder joint and upper arm
 - 1 x red wire = 48V DC
 - 1 x black wire = GND
 - Black connector = bus cable



- Unmount screws around the upper arm as indicated on the illustration:



- Pull away the Shoulder joint from upper arm.
- Replace Shoulder joint and mount screws into shoulder joint.
- Tighten screws lightly, then tighten in cross order with 3.0Nm.
- Reconnect wires as illustrated

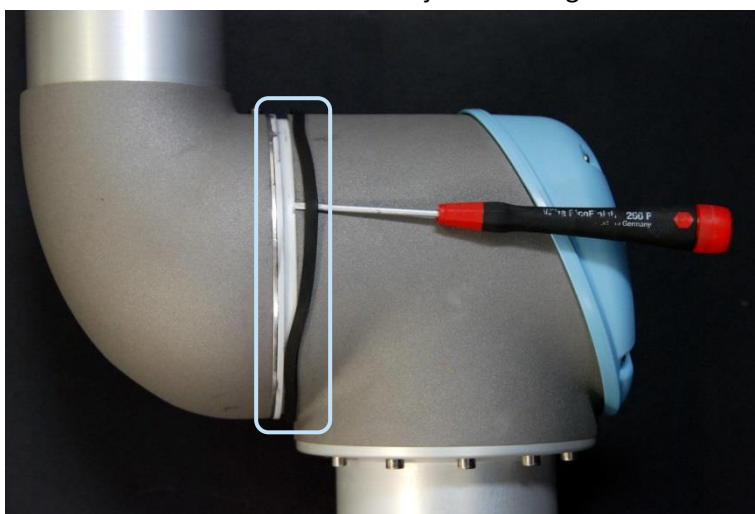


- Mount blue lid on Base joint and tighten with 0.5Nm.
- Proceed to chapter [3.1.11 Joint calibration](#) for calibrating the joint.

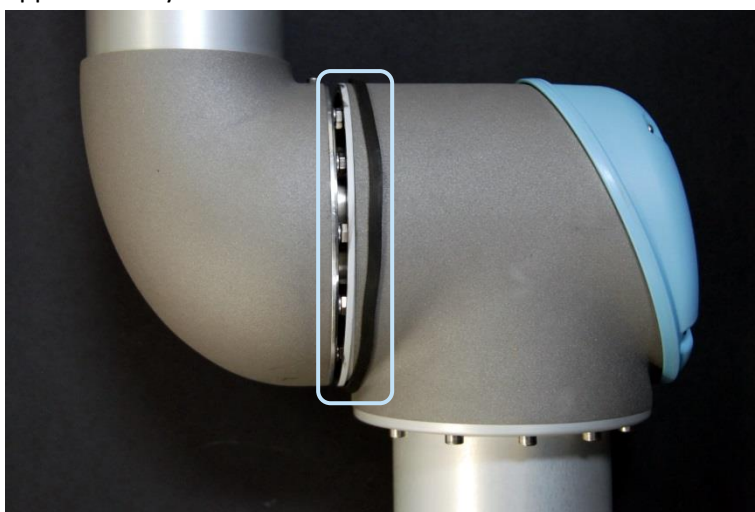
3.1.6 Replacement of Elbow joint

How to replace Elbow joint

- Move robot to a comfortable position for replacing the joint. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- Remove grease plug at Elbow joint.
- Gently remove black flexible flat ring between Elbow and lower arm with a tiny screwdriver or similar tool and twist it around the joint housing.



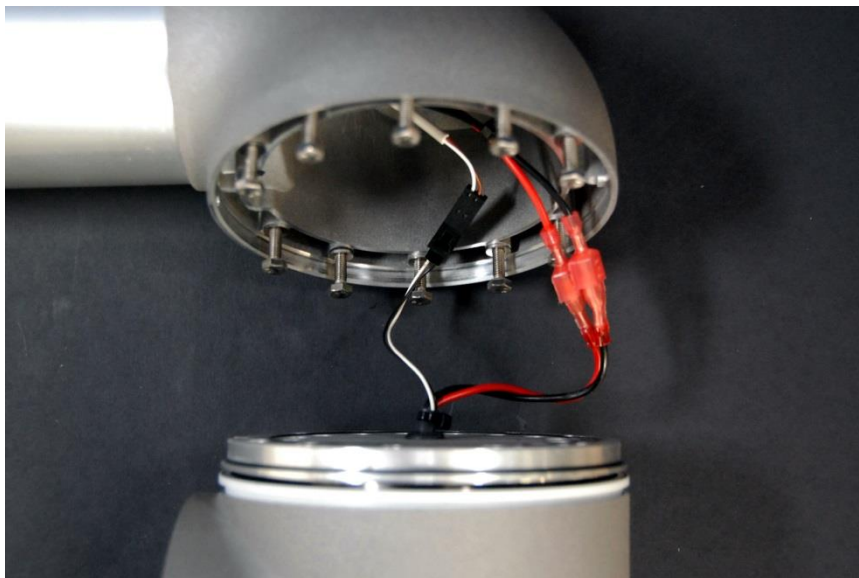
- Slide the grey Teflon ring apart.
10 screws become visible, 5 on each side of joint.
Untighten gently the screw with a 7 mm. open-ended spanner about two full rounds, approximately 3 mm. for each screw.



- Pull Elbow joint and lower arm apart and gently twist the two parts in opposite directions around 10 mm. until a mechanical stop is met (holes are keyhole-type).



- Pull away the Elbow joint from lower arm.



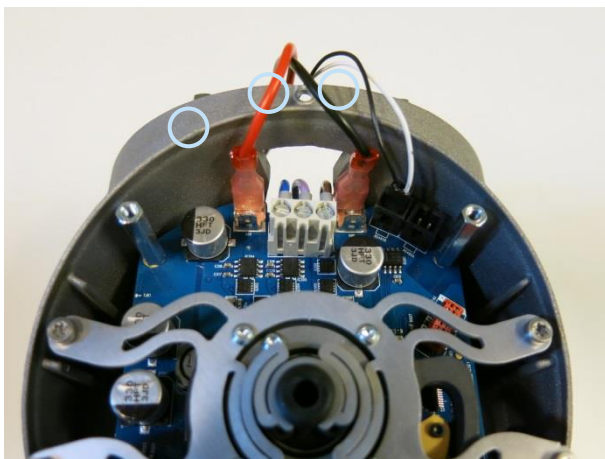
- Disconnect wires between Elbow joint and lower arm

| | |
|-----------------|-------------|
| 1 x red wire | = 48V DC |
| 1 x black wire | = GND |
| Green connector | = bus cable |
- Replace Elbow joint and reconnect wires between Elbow joint and lower arm accordingly.
- Gently insert lower arm with screws and washers into the Elbow joint.
- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting the Elbow joint and lower arm in opposite directions until a mechanical stop is met.
- Tighten the 10 screws lightly, then tighten in cross order with respectively 3.0Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
- Mount the grease plug and tighten with 0.8Nm.

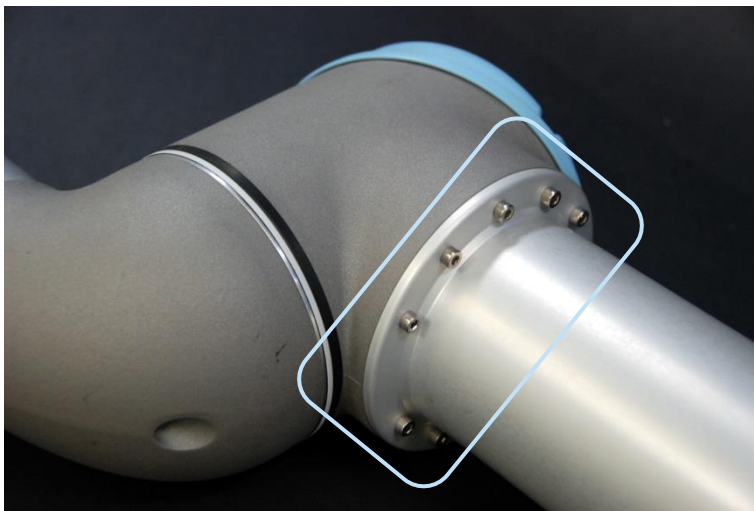
- For separating upper arm from Elbow joint, remove blue lid on Shoulder joint.



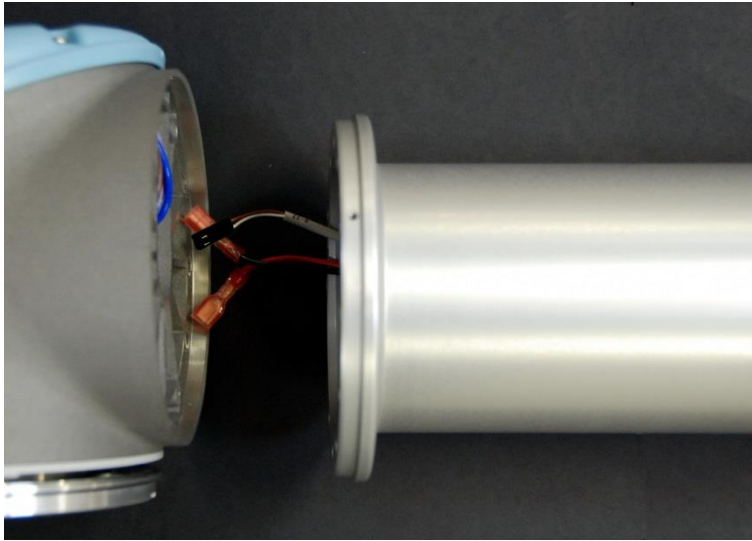
- Disconnect wires between Elbow joint and upper arm
1 x red wire = 48V DC
1 x black wire = GND
Black connector = bus cable



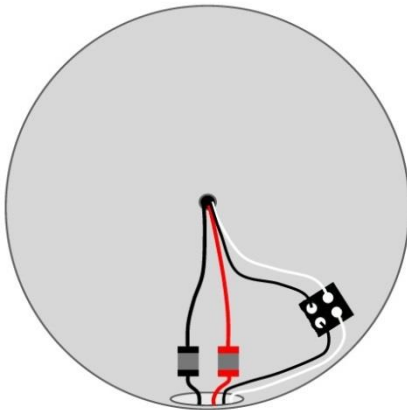
- Unmount screws around the upper arm as indicated on the picture.



- Pull away the Elbow joint from upper arm.



- Replace Elbow joint and gently insert lower arm into the Elbow joint.
- Tighten the 10 screws lightly, then tighten in cross order with respectively 3.0Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
- Mount the grease plug and tighten with 0.8Nm.
- Reconnect wires between Elbow joint and upper arm as illustrated

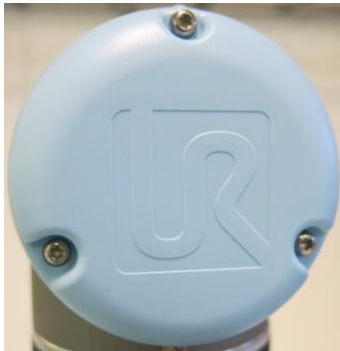


- Mount blue lid on Base joint and tighten with 0.5Nm.
- Proceed to chapter [3.1.11 Joint calibration](#) for calibrating the joint.

3.1.6 Replacement of Wrist 1 joint

How to replace Wrist 1 joint

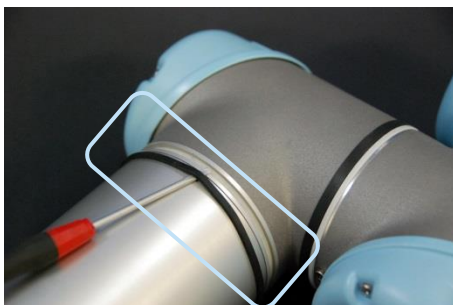
- Move robot to a comfortable position for replacing the joint. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- Remove blue lid on Wrist 1 joint.



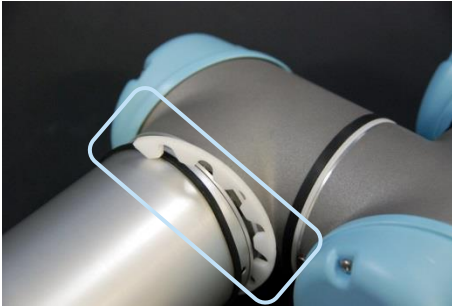
- Disconnect wires between lower arm and Wrist 1 joint.
1 x red wire = 48V DC
1 x black wire = GND
Black connector = bus cable



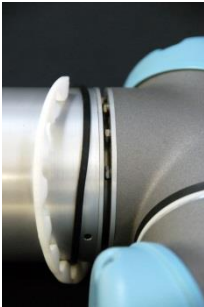
- Gently remove black flexible gasket between lower arm and Wrist 1 joint with a tiny screwdriver or similar tool and twist it around the lower arm.



- With a screw driver or similar tool, gently remove nylon ring as illustrated



- 8 screws become visible, 4 on each side of joint.



Untighten gently the screws with a 5.5 mm. open-ended spanner about two full rounds, approximately 3 mm. for each screw.

- Pull the lower arm and Wrist 1 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).



- Pull away the lower arm from Wrist 1 joint.
- Lower arm and Wrist 1 joint has now been separated, proceed for separating Wrist 1 from Wrist 2.

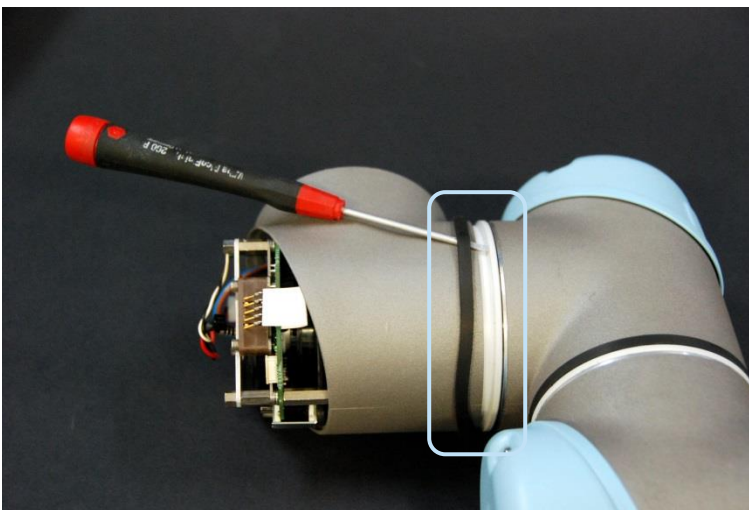
- Remove blue lid on Wrist 2 joint.



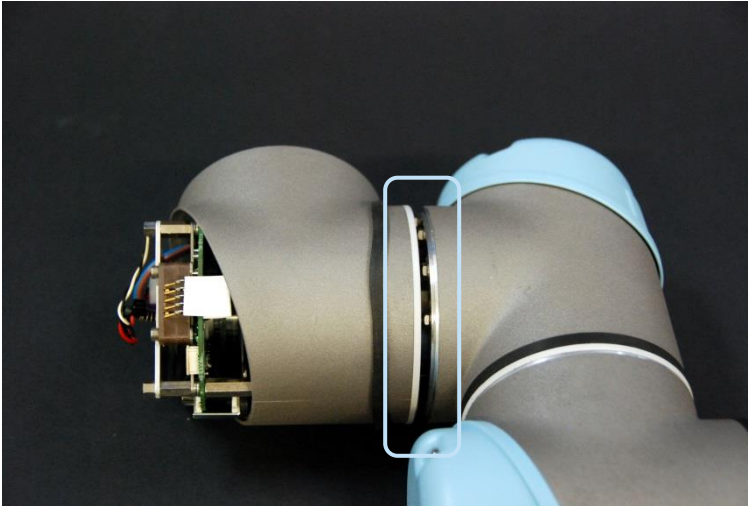
- Disconnect wires between Wrist 1 joint and Wrist 2 joint
1 x red wire = 48V DC
1 x black wire = GND
Black connector = bus cable



- Gently remove black flexible flat ring between Wrist 1 and Wrist 2 with a tiny screwdriver or similar tool and twist it around the joint housing.



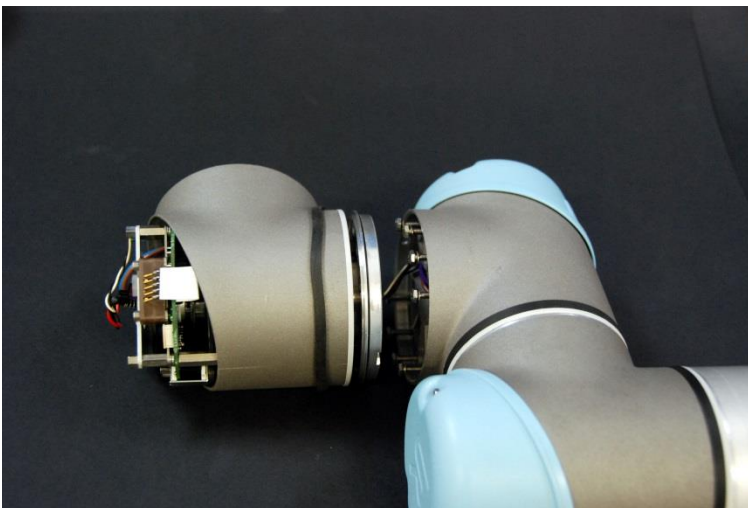
- Slide the grey Teflon ring apart.
8 screws become visible, 4 on each side of joint.
Untighten gently the screws with a 5.5 mm. open-ended spanner about two full rounds,
approximately 3 mm. for each screw.



- Pull Wrist 1 joint and Wrist 2 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).

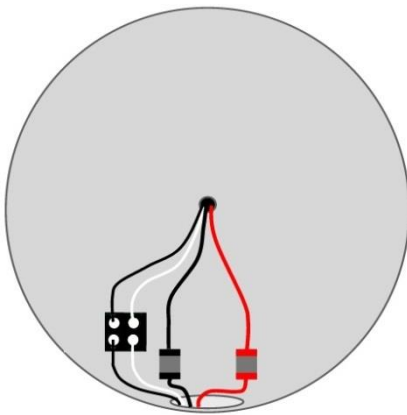


- Pull away Wrist 1 joint from Wrist 2 joint.



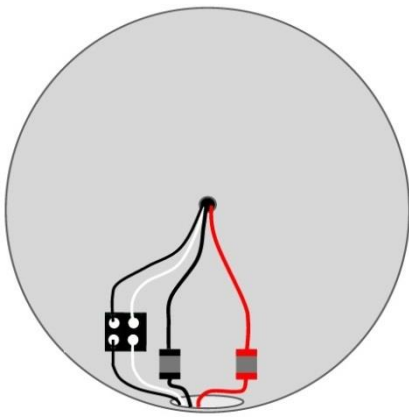
- Wrist 1 joint and Wrist 2 joint has now been separated, proceed for assembling new Wrist 1 joint with Wrist 2 joint.

- Replace Wrist 1 and gently insert Wrist 1 joint with screws and washers into Wrist 2 joint.
- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting Wrist 1 joint and Wrist 2 joint in opposite directions until a mechanical stop is met.
- Tighten the 8 screws lightly, then tighten in cross order with 1.3Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
- Mount the grease plug and tighten with 0.8Nm.
- Reconnect connectors as illustrated into Wrist 2.



- Mount blue lid on Wrist 2 joint and tighten with 0.5Nm.
- New Wrist 1 joint and Wrist 2 joint has now been assembled, proceed for assembling new Wrist 1 joint and lower arm.

- Gently insert Wrist 1 joint with screws and washers into the lower arm.
- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting Wrist 1 joint and lower arm in opposite directions until a mechanical stop is met.
- Tighten the 8 screws lightly, then tighten in cross order with 1.3Nm.
- Gently put back the gasket.
- Mount the grease plug and tighten with 0.8Nm.
- Reconnect wires between lower arm and Wrist 1 joint as illustrated



- Mount blue lid on Wrist 1 joint and tighten with 0.5Nm.
- Proceed to chapter [3.1.11 Joint calibration](#) for calibrating the joint.

3.1.7 Replacement of Wrist 2 joint

How to replace Wrist 2 joint

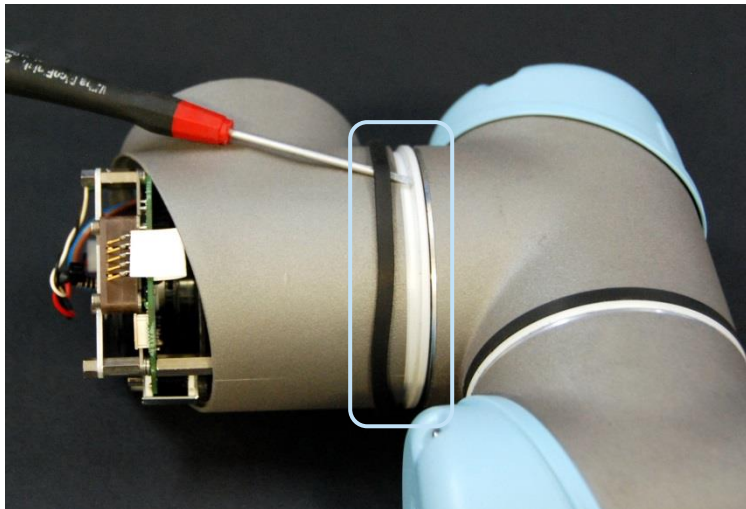
- Move robot to a comfortable position for replacing the joint. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- Remove blue lid on Wrist 2 joint.



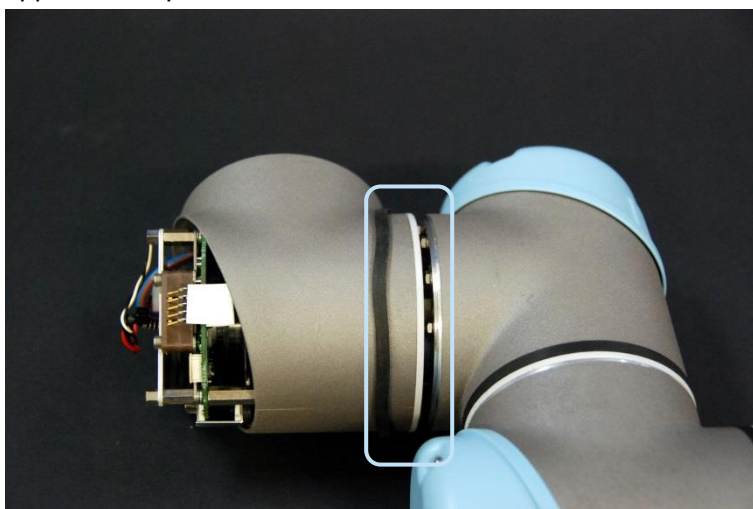
- Disconnect wires between Wrist 1 joint and Wrist 2 joint
2 x red wire = 48V DC
2 x black wire = GND
Black connector = bus cable



- Gently remove black flexible flat ring between Wrist 1 and Wrist 2 with a tiny screwdriver or similar tool and twist it around the joint housing.



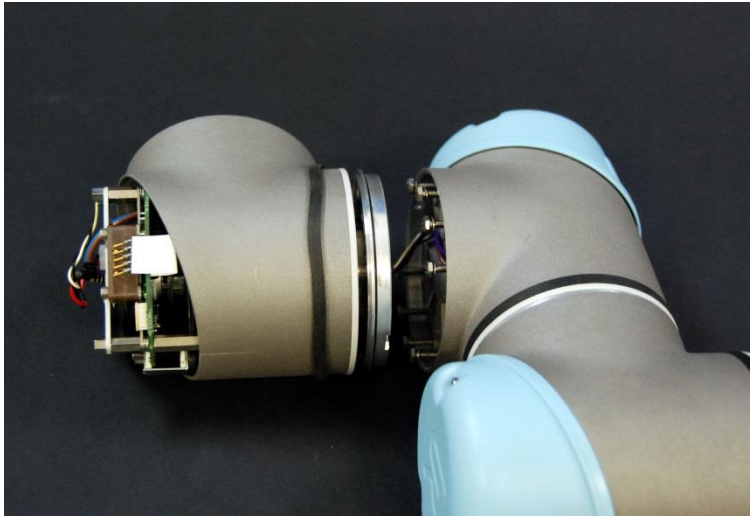
- Slide the grey Teflon ring apart.
8 screws become visible, 4 on each side of joint.
Untighten gently the screws with a 5.5 mm. open-ended spanner about two full rounds, approximately 3 mm. for each screw.



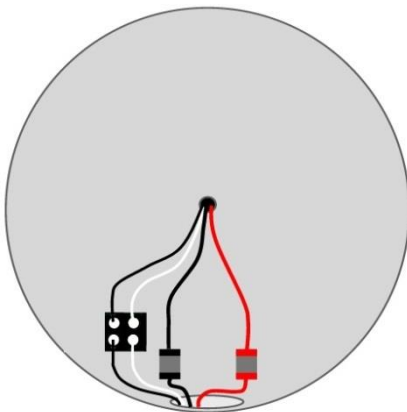
- Pull Wrist 1 joint and Wrist 2 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).



- Pull away Wrist 1 joint from Wrist 2 joint.



- Wrist 1 joint and Wrist 2 joint has now been separated. Perform same procedure for separating Wrist 2 joint and Wrist 3 joint and proceed when done.
- Replace Wrist 2 and gently insert Wrist 2 joint with screws and washers into Wrist 1 joint.
- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting the Wrist 1 joint and Wrist 2 joint in opposite directions until a mechanical stop is met.
- Tighten the 8 screws lightly, then tighten in cross order with 1.3Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
- Mount the grease plug and tighten with 0.8Nm.
- Reconnect connectors as illustrated into Wrist 2.

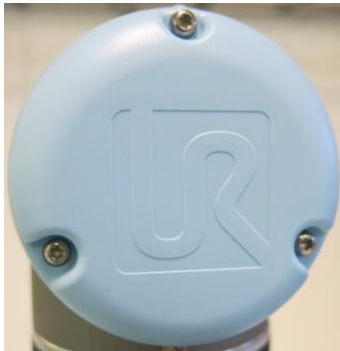


- Mount blue lid on Wrist 2 joint and tighten with 0.5Nm.
- Wrist 1 joint and Wrist 2 joint has now been assembled. Perform same procedure for assembling Wrist 2 joint and Wrist 3 joint.
- Proceed to chapter [3.1.11 Joint calibration](#) for calibrating the joint.

3.1.8 Replacement of Wrist 3 joint

How to replace Wrist 3 joint

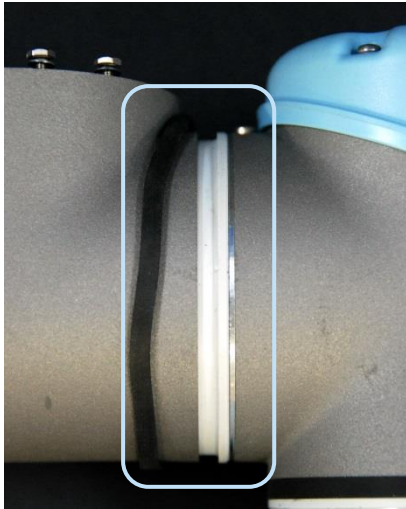
- Move robot to a comfortable position for replacing the joint. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- Remove blue lid on Wrist 3 joint.



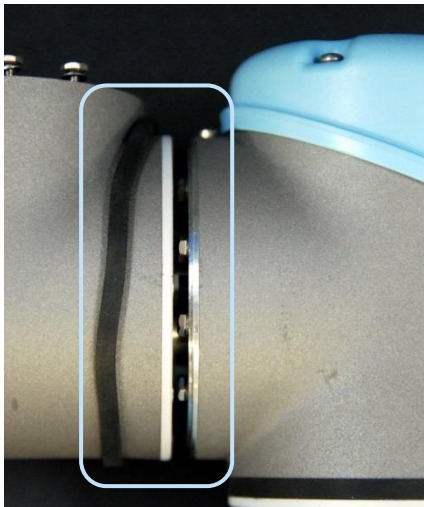
- Disconnect wires between Wrist 2 joint and Wrist 3 joint
2 x red wire = 48V DC
2 x black wire = GND
Black connector = bus cable



- Gently remove black flexible flat ring between Wrist 2 and Wrist 3 with a tiny screwdriver or similar tool and twist it around the joint housing.



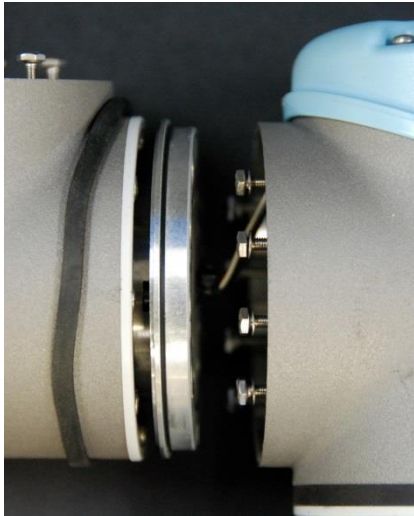
- Slide the grey Teflon ring apart.
8 screws become visible, 5 on each side of joint.
Untighten gently the screws with a 5.5 mm. open-ended spanner about two full rounds, approximately 3 mm. for each screw.



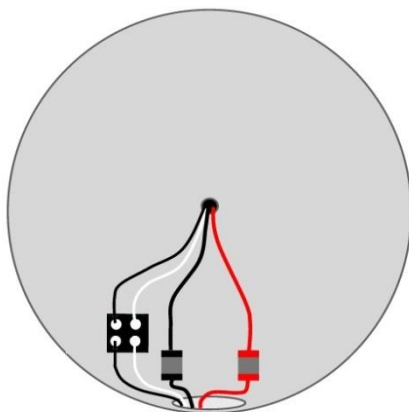
- Pull Wrist 2 joint and Wrist 3 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).



- Pull away Wrist 2 joint from Wrist 3 joint.



- Wrist 2 joint and Wrist 3 joint has now been separated.
- For separating Wrist 3 joint from tool flange, consult chapter [3.1.9 Replacement of tool flange](#).
- Replace Wrist 3 and gently insert Wrist 3 joint with screws and washers into Wrist 2 joint.
- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting the Wrist 2 joint and Wrist 3 joint in opposite directions until a mechanical stop is met.
- Tighten the 8 screws lightly, then tighten in cross order with 1.3Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.
- Mount the grease plug and tighten with 0.8Nm.
- Reconnect connectors as illustrated into Wrist 3.

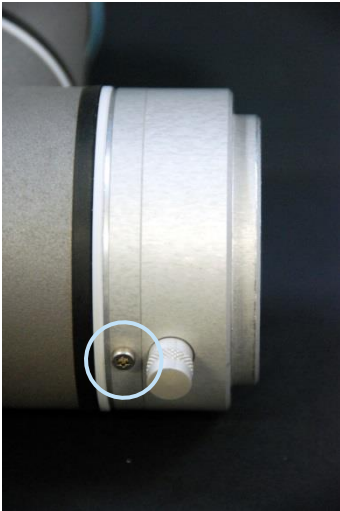


- Mount blue lid on Wrist 3 joint and tighten with 0.5Nm.
- Wrist 2 joint and Wrist 3 joint has now been assembled.
- For assembling Wrist 3 joint and tool flange, consult chapter [3.1.9 Replacement of tool flange](#).
- Proceed to chapter [3.1.11 Joint calibration](#) for calibrating the joint.

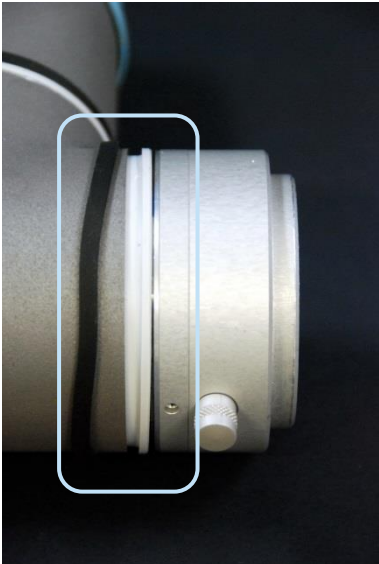
3.1.9 Replacement of tool flange

How to replace tool flange

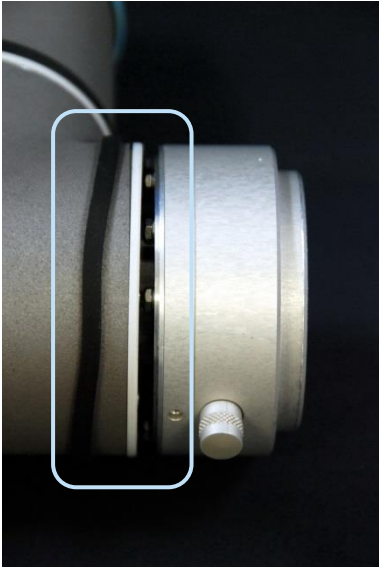
- Move robot to a comfortable position for replacing the tool flange. If necessary dismount entire robot arm from work cell and place arm on solid surface.
- Shut down the controller.
- Remove grease plug.



- Gently remove black flexible flat ring with a tiny screwdriver or similar tool and twist it around the joint housing.



- Slide the grey Teflon ring apart.
8 screws become visible, 5 on each side of joint.
Untighten gently the screws with a 5.5 mm. open-ended spanner about two full rounds, approximately 3 mm. for each screw.



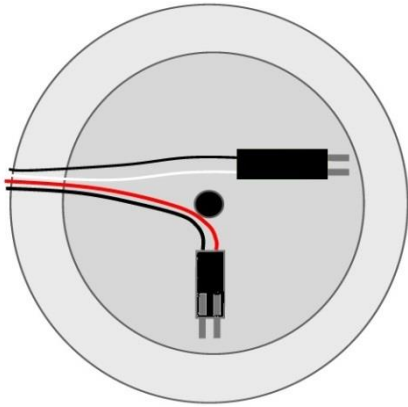
- Pull the tool flange and Wrist 3 joint apart and gently twist the two parts in opposite directions around 8 mm. until a mechanical stop is met (holes are keyhole-type).



- Pull away the tool from Wrist 3 joint.
- Disconnect the two connectors.



- Replace tool flange and reconnect connectors as illustrated.



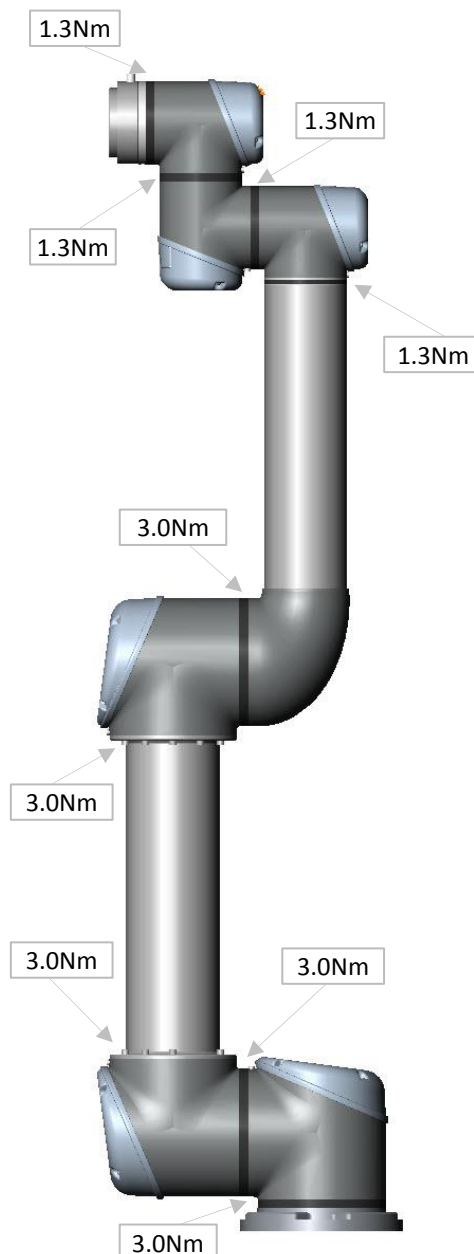
- Replace tool and reconnect wires correctly.
- Gently insert tool flange with screws and washers into the Wrist 3 joint.
- Make sure the washers are fully inserted and located on the correct side (this is important) before gently twisting the tool flange and Wrist 3 joint in opposite directions until a mechanical stop is met.
- Tighten the 8 screws lightly, then tighten in cross order with 1.3Nm.
- Slide the grey Teflon ring in place and gently put back the flat ring on top of the Teflon ring.



- Mount the grease plug and tighten with 0.8Nm.

3.1.10 Torque values

| UR5 torque values | | | |
|-------------------|---------------|--------|-----------|
| CONNECTION | | TORQUE | HEAD SIZE |
| BASE PLATE | J0 BASE | 3.0Nm | 7 mm. |
| [J0] BASE | [J1] Shoulder | 3.0Nm | 7 mm. |
| [J1] SHOULDER | LOWER ARM | 3.0Nm | 7 mm. |
| LOWER ARM | [J2] ELBOW | 3.0Nm | 7 mm. |
| [J2] ELBOW | HIGHER ARM | 3.0Nm | 7 mm. |
| HIGHER ARM | [J3] WRIST 1 | 1.3Nm | 5.5 mm. |
| [J3] WRIST 1 | [J4] WRIST 2 | 1.3Nm | 5.5 mm. |
| [J4] WRIST 2 | [J5] WRIST 3 | 1.3Nm | 5.5 mm. |
| [J5] WRIST 3 | TOOL | 1.3Nm | 5.5 mm. |
| Blue lid | | 0.5Nm | Torx 10 |



3.1.11 Joint calibration

After replacement of joint it is required to calibrate the new joint in order to find the correct zero position of joint.

Instruction for calibrating a joint

- Jog robot to HOME position

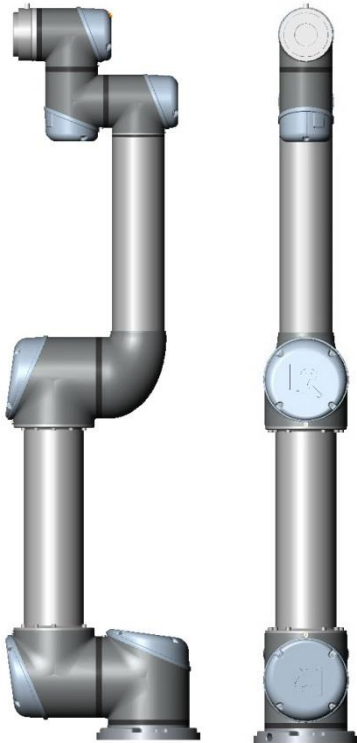
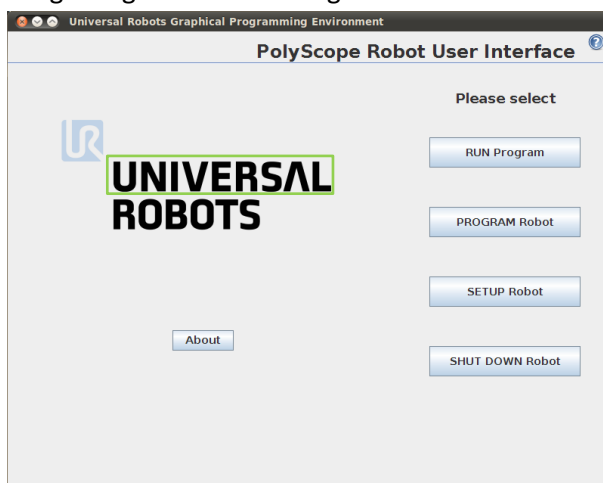
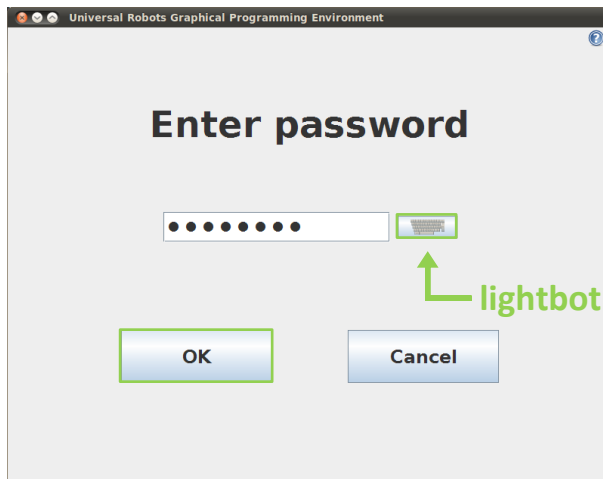


Illustration shows the HOME position, which is defined as zero position of all joints.

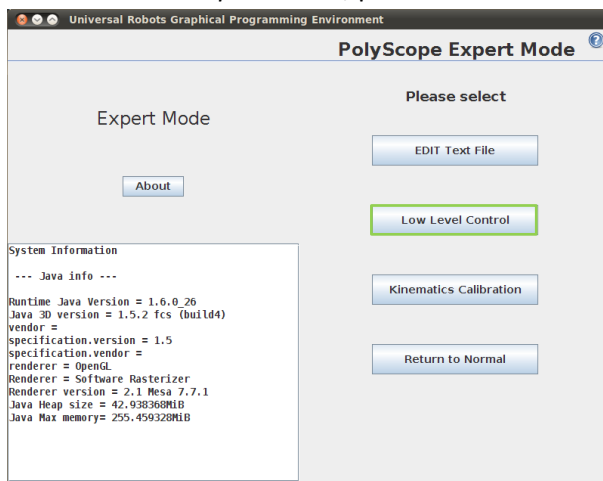
- Drag a finger from left to right across the *UNIVERSAL*-sign on main screen of PolyScope.



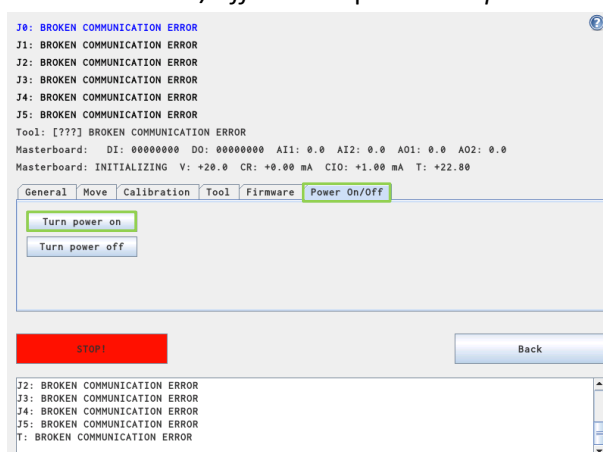
- Enter password *lightbot* and press *OK*.



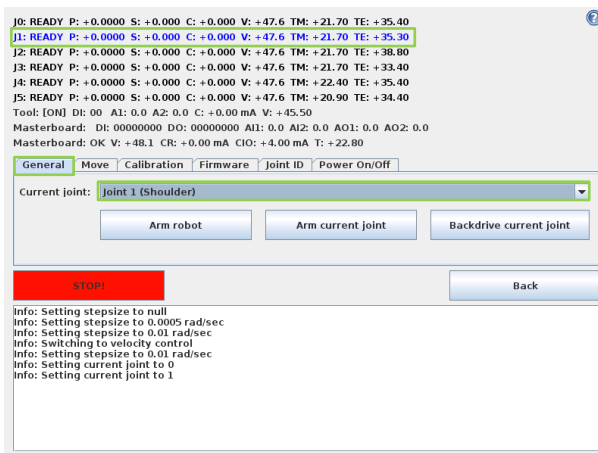
- You are now in *Expert Mode*, press *Low Level Control*.



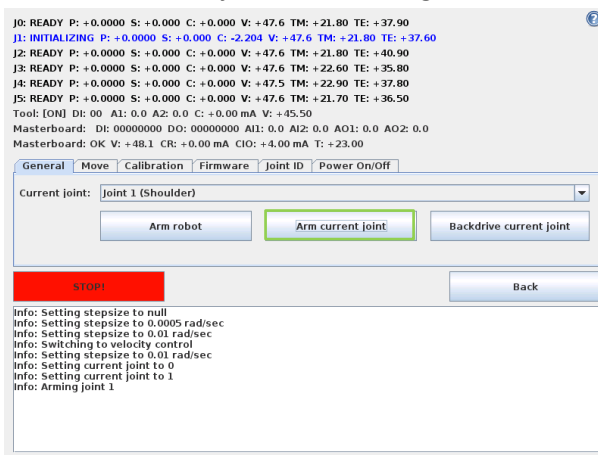
- Select *Power On/Off* tab and press *Turn power on* for enabling power to motors.



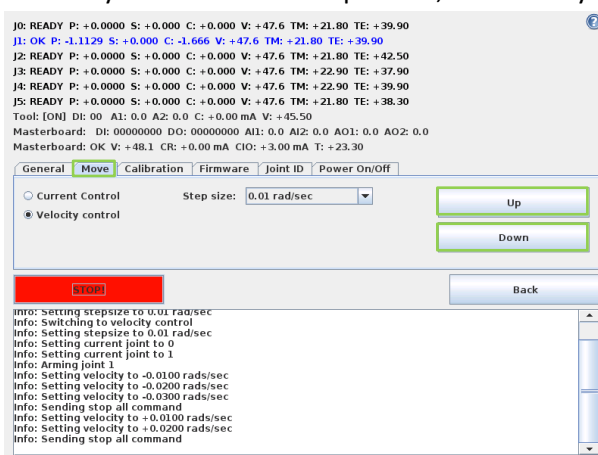
- Select *General* tab, and select the desired joint by either using the dropdown list or directly press on the joint state line.



- Press *Arm current joint* for releasing the brake on the selected joint.

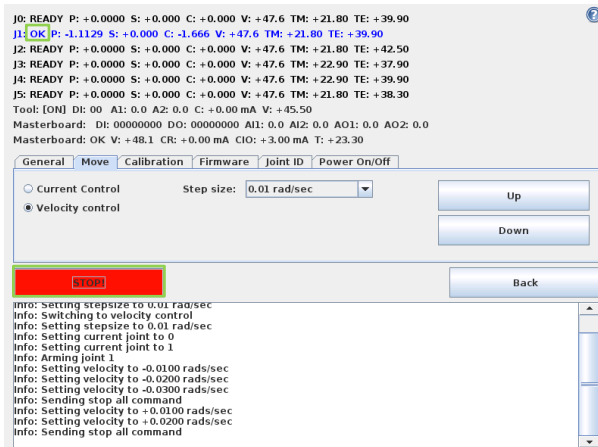


- Select *Move* tab and press either *Up* or *Down* for the joint to find its index mark. For every time the button is pressed, the velocity of joint will be increased.



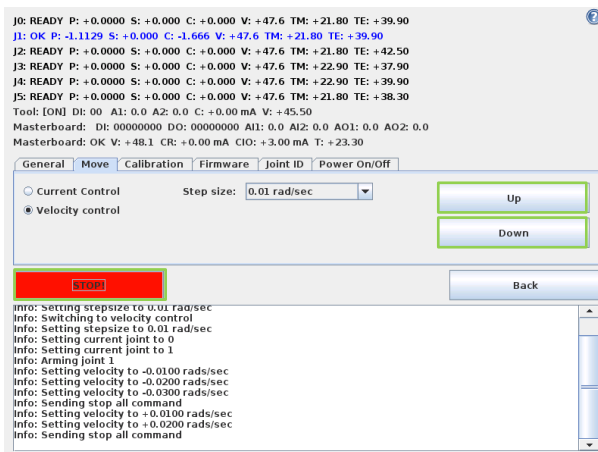
- Await that state of the joint changes to *OK*, then press *STOP*.

Index mark has now been found (index mark is not the same position as zero position).



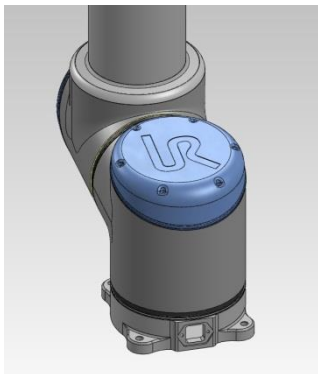
- Use the *Up* and *Down* buttons for navigating the joint to the correct zero position according to the following illustrations.

Press *STOP* when the joint is in the correct position.



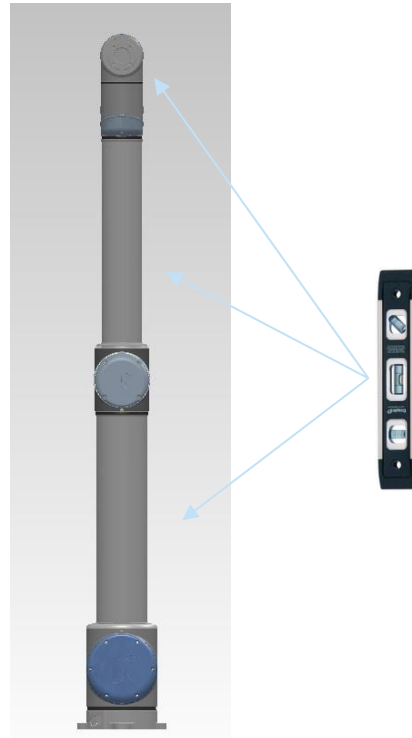
- Zero position illustrations

Base:



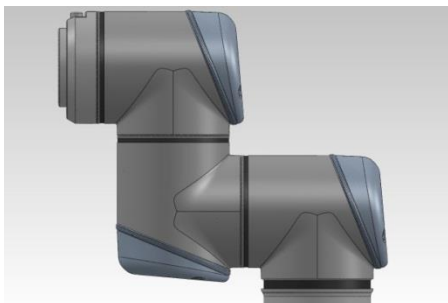
Base zero position is aligned to connector in back of robot base.

Shoulder, Elbow, Wrist 1:



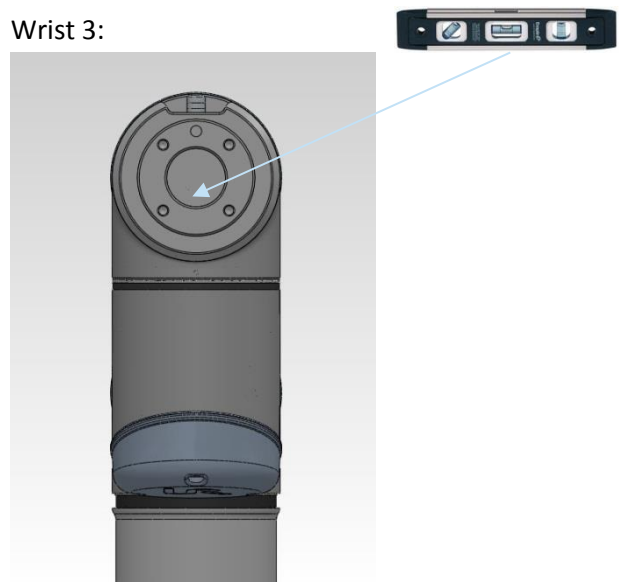
Shoulder, Elbow and Wrist 1 zero positions are Vertical aligned (if Base is horizontal).
Make sure that base of robot is positioned horizontal, use leveler for aligning joints.

Wrist 2:



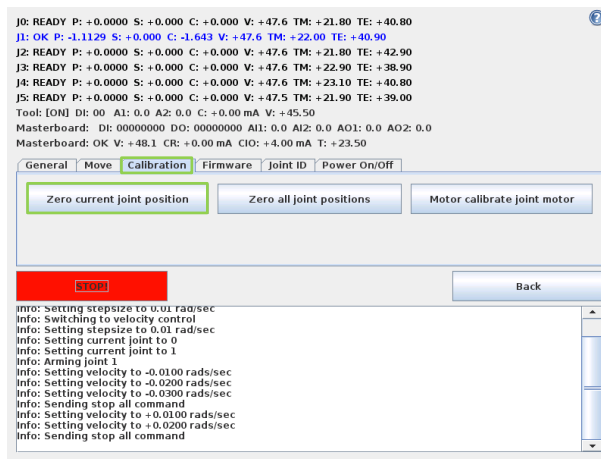
Wrist 2 zero position is aligned similar to Base joint.

Wrist 3:

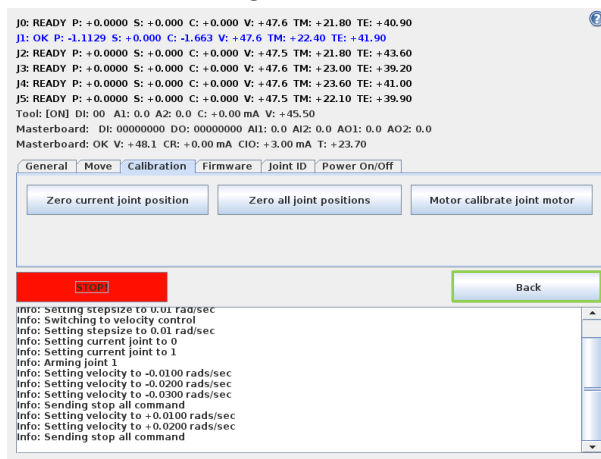


Wrist 3 zero position is aligned so tool connector is pointing upward.
Mount two bolts in tool holes and use leveler for aligning joint.

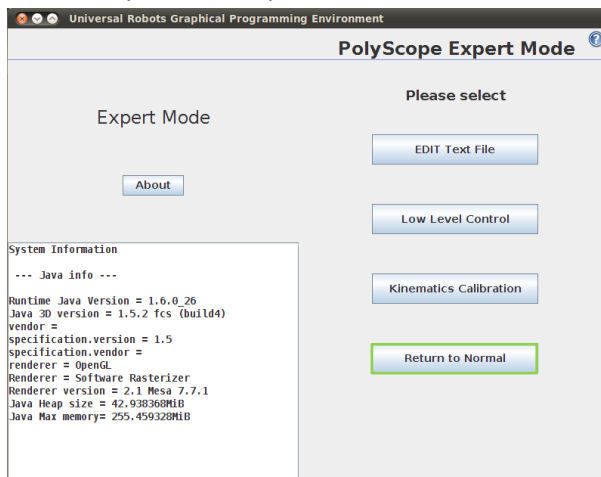
- Select *Calibration* tab and press *Zero current joint position* for calibrating the joint.



- Press *Back* for exiting Low Level Control.



- Back in Expert Mode, press *Return to Normal*.



- Verify zero position by moving the robot to HOME.
If not satisfied with the zero position, perform the procedure once again.

3.2 Controller

3.2.1 Handling ESD-sensitive parts

To prevent damage to ESD-sensitive parts, follow the instructions below in addition to all the usual precautions, such as turning off power before removing logic cards:

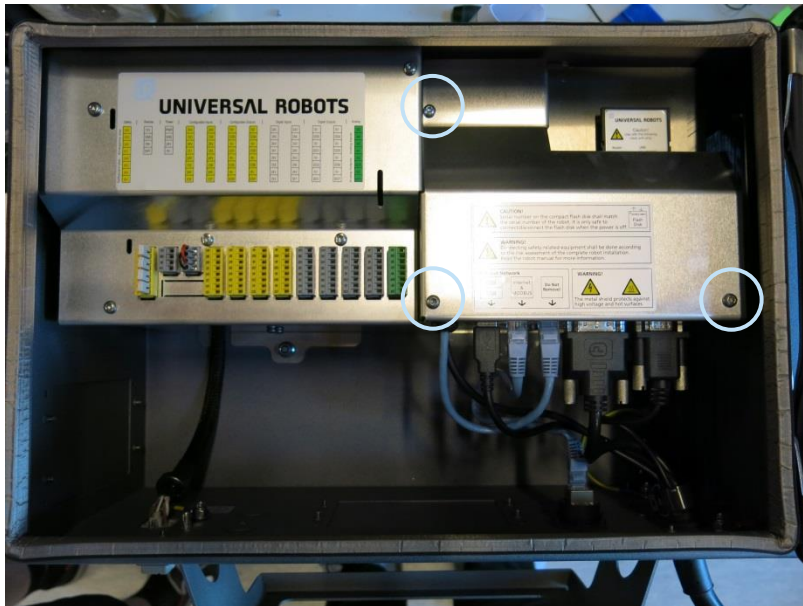
- **Keep the ESD-sensitive part in its original shipping container** (a special "ESD bag") until the part is ready to be installed.
- Make the least-possible body movements to prevent an increase of static electricity from clothing fibers, carpets, and furniture.
- **Put the ESD wrist strap on your wrist. Connect the wrist band to the system ground point.** This discharges any static electricity in your body to ground.
- Hold the ESD-sensitive part by its edges; do not touch its pins. If a pluggable module is being removed, then use the correct tool.
- Do not place the ESD-sensitive part on insulating or on a metal table; if the ESD-sensitive part needs to be put down for any reason, then first put it into its special bag.
- **Machine covers and metal tables are electrical grounds. They increase the risk of damage** because they make a discharge path from your body through the ESD-sensitive part. (Large metal objects can be discharge paths without being grounded.)
- Prevent ESD-sensitive parts from being accidentally touched by other personnel and do not put unprotected ESD-sensitive parts on a table.
- If possible, keep all ESD-sensitive parts in a grounded metal cabinet (case).
- **Be extra careful in working with ESD-sensitive parts when cold-weather heating is used,** because low humidity increases static electricity

3.2.2 Replacement of motherboard

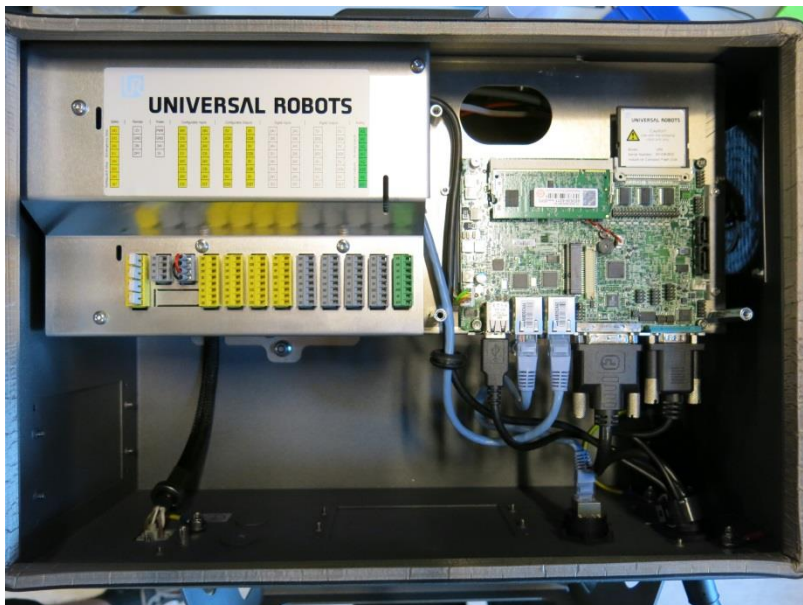
Take care of ESD handling [3.2.1 Handling ESD-sensitive parts](#)

How to replace motherboard in Controller box

- Shut down the controller and disconnect the power cable, open the controller cabinet and loosen the 3 Torx screws



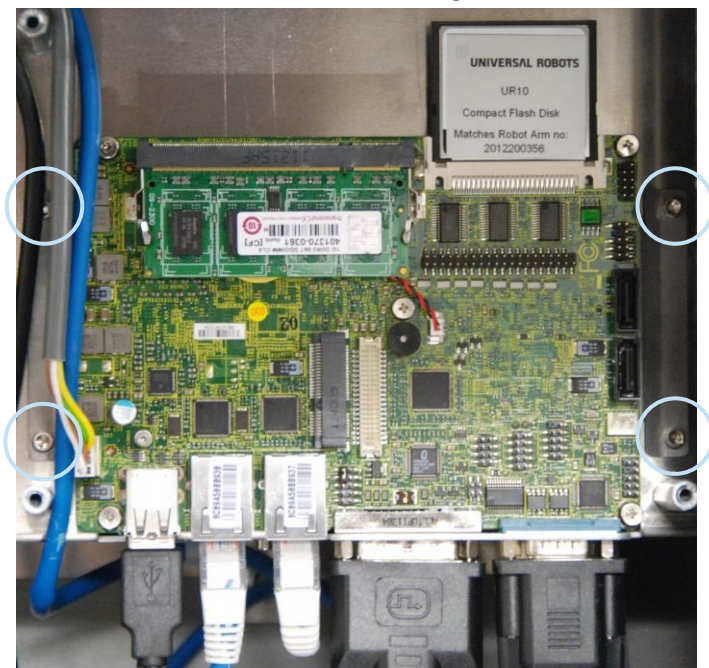
- and remove the alu cover plate.



- Disconnect cable connections from motherboard:
2x RJ45 network cables
Black USB cable
DVI-cable
Black cable for RS232-connection
White plug with white, brown, yellow and green wires



- Remove the 4 screws of the 2 holding brackets.



- Replace Motherboard with new.
- If controller is equipped with long-hole brackets, make sure to replace them with circular-hole brackets. Tighten the 4 screws gently.

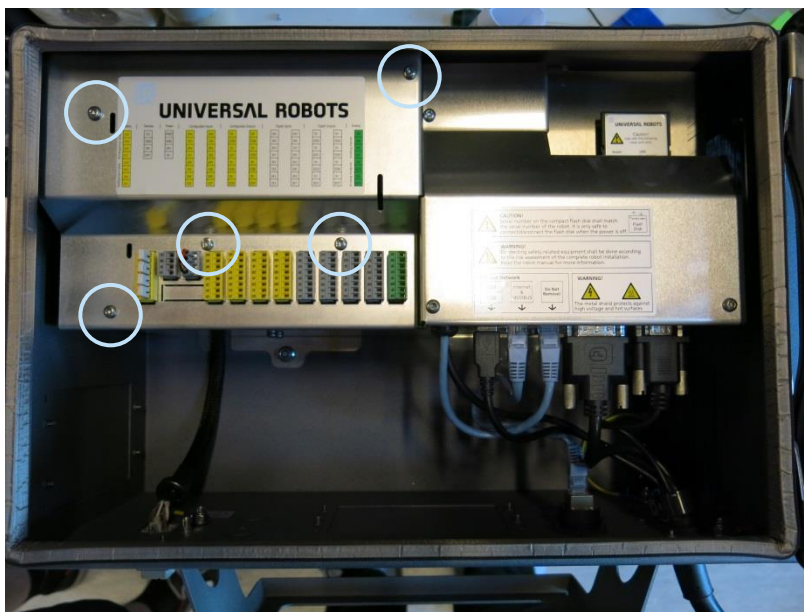
- Insert the 6 cables in correct positions.
- Re-install Flash card and RAM block.
- Carefully put back the grey alu cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

3.2.3 Replacement of Safety Control Board

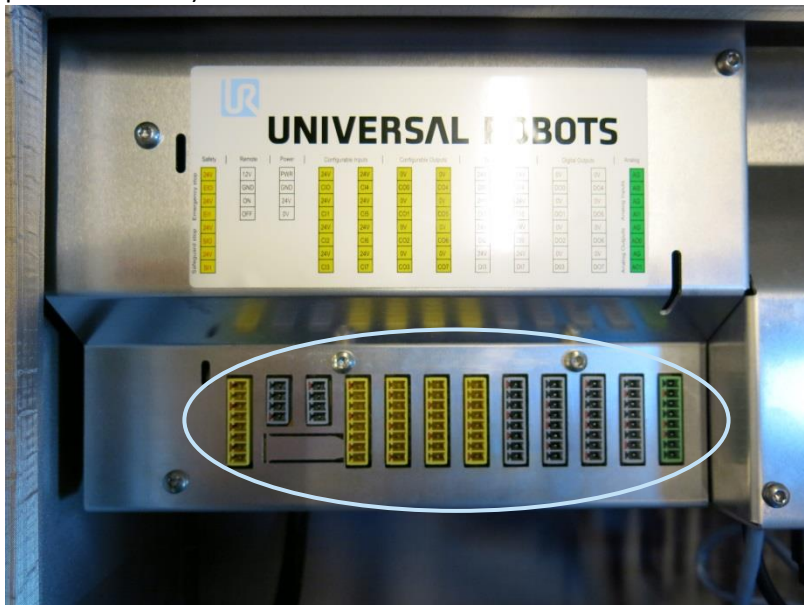
Take care of ESD handling [3.2.1 Handling ESD-sensitive parts](#)

How to replace Safety Control Board in Controller box

- Shut down the controller and disconnect the power cable, open the controller cabinet and loosen the 5 Torx screws

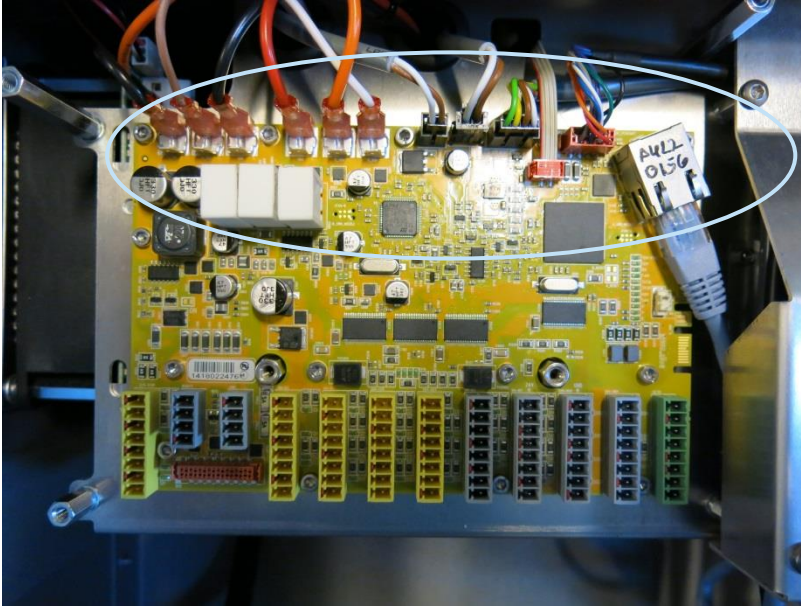


- Carefully remove all plugs and connectors (it is recommended to mark the cable positions or take a picture of them).



- and remove the alu cover plate.

- Carefully remove all plugs and connectors (it is recommended to mark the cable positions or take a picture of them).



- Remove 13 screws holding the Safety Control Board.
- Replace Safety Control Board with new and tighten the 15 screws to hold the board
- Insert all connectors and plugs in correct positions.
- Carefully put back the grey alu cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

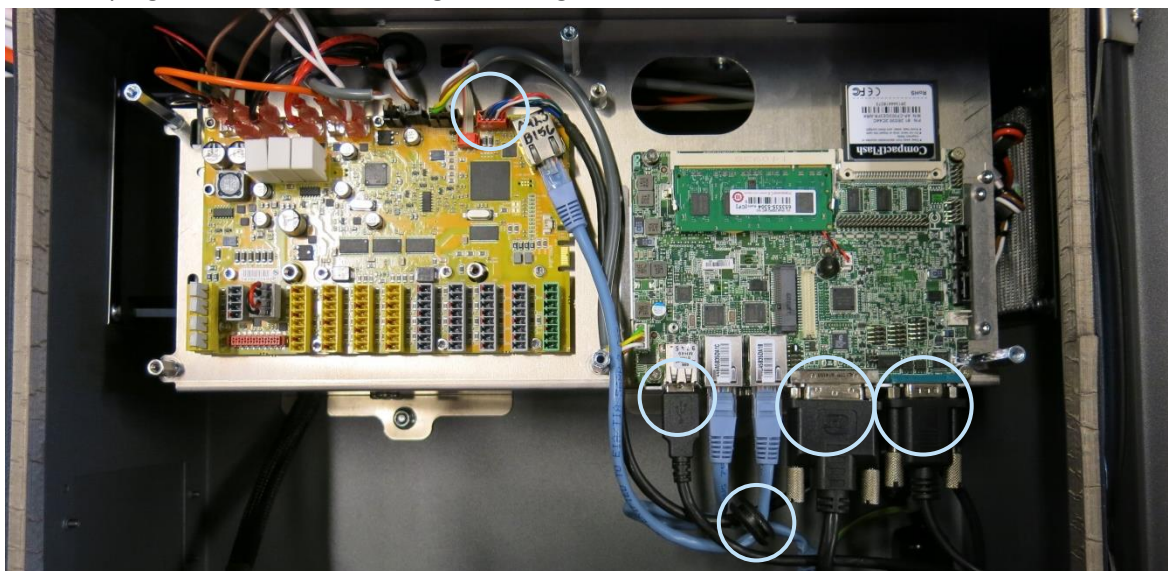
3.2.4 Replacement of teach pendant

Take care of ESD handling [3.2.1 Handling ESD-sensitive parts](#)

How to replace Teach Pendant on Controller

Note: use the same procedure for power down and removing the alu cover plates as in chapter [3.2.2 Replacement of motherboard](#) and [3.2.3 Replacement of Safety Control Board](#)

- Disconnect 4 cables:
 Red plug with black cable
 Black USB cable
 Black DVI cable
 Black cable for RS232-connection to touchscreen
 Pull Red plug with black cable through rubber gasket.



- Remove the bracket (foot of the controller box) that holds the cable inlet and pull out the cables and plugs through this hole.



- Replace teach pendant with new, insert cable in cable inlet and perform reconnection of all plugs and mounting of alu cover in reversed order of the above description.
- Connect power and verify that teach pendant works properly.

3.2.5 Replacement of 48V power supply

Take care of ESD handling [3.2.1 Handling ESD-sensitive parts](#)

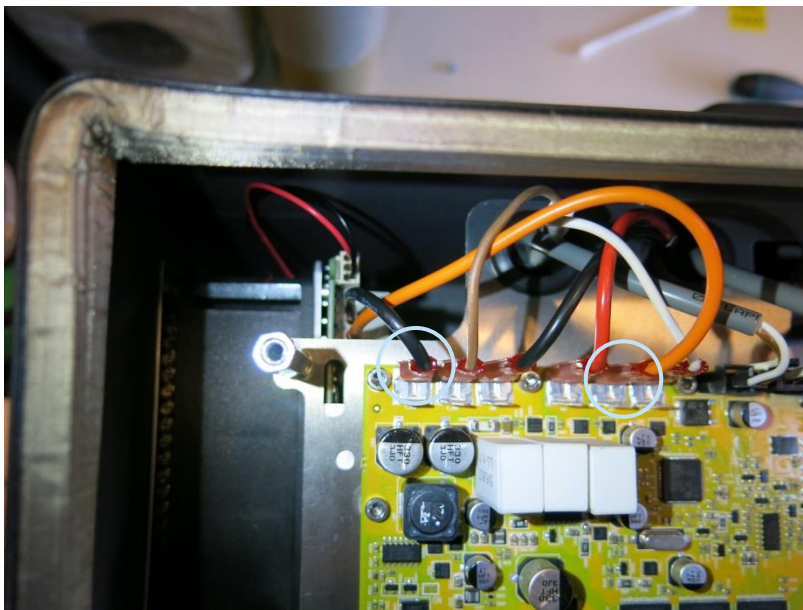
How to replace 48V power supply in Controller box

Note: use the same procedure for power down and removing the alu cover plates as in chapter [3.2.2 Replacement of motherboard](#) and [3.2.3 Replacement of Safety Control Board](#)

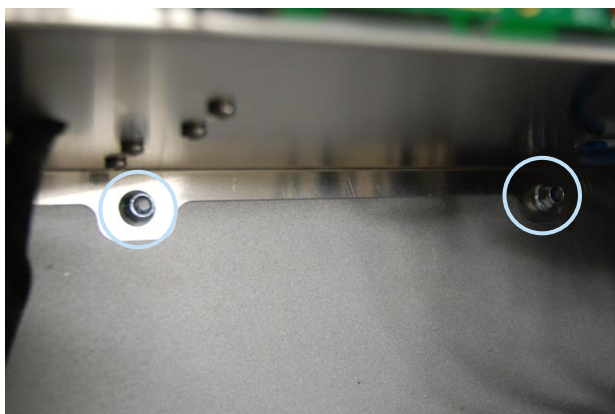
- Remove the handle on Controller box by loosen the 2 screws holding it.



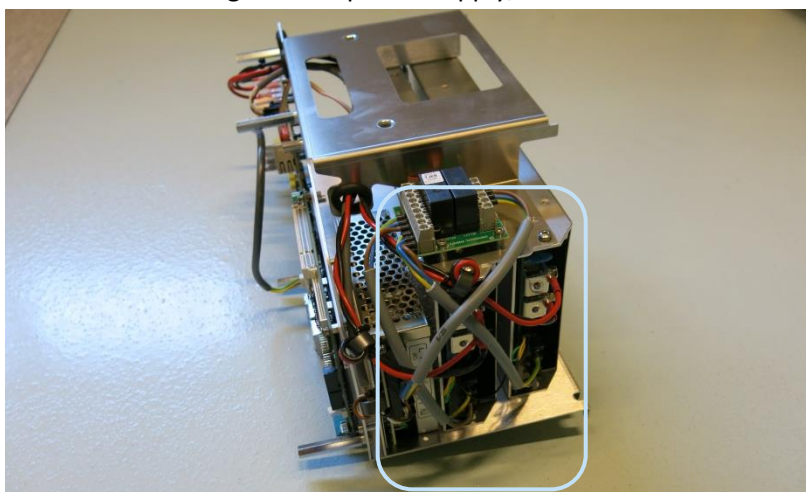
- Removes the 2 wires for the fan.



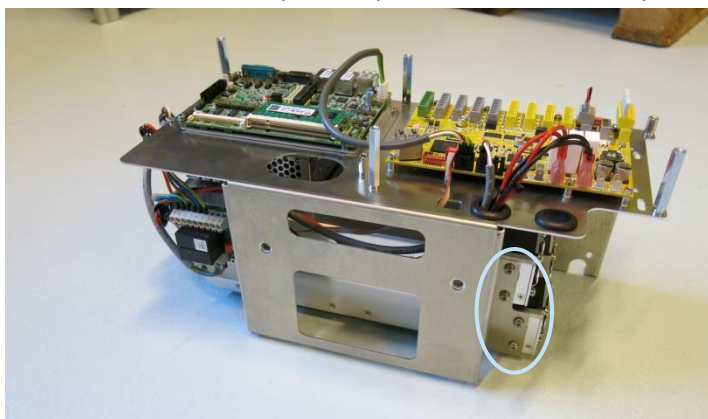
- Remove the 2 nuts in the bottom of Controller module.

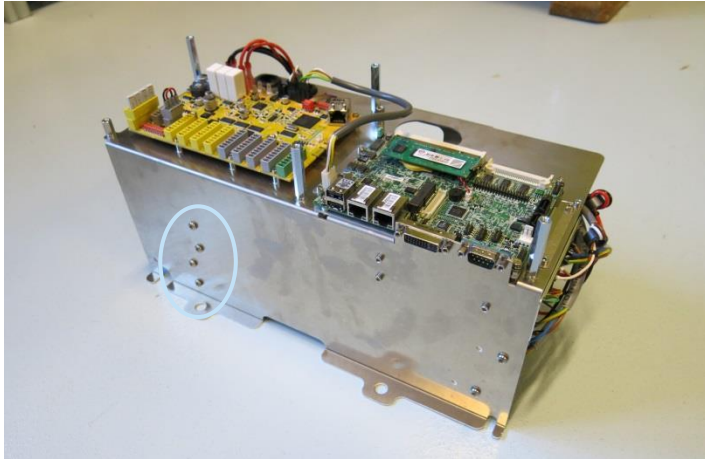


- Gently take out the controller module from the Controller box without disconnecting the robot cable and power cable.
- Power supplies are located in the rack under the controller module, the two 48V power supplies are the lower ones in the rack.
Before dismounting the 48V power supply, mark and disconnect the cables from that supply.



- Remove the screws respectively of the defective 48V power supply from the side of the rack.





- Replace 48V power supply with new.
- Reconnect the wires for the 48V power supply.
- Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.
- Carefully put back the grey alu cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

3.2.6 Replacement of 12V power supply

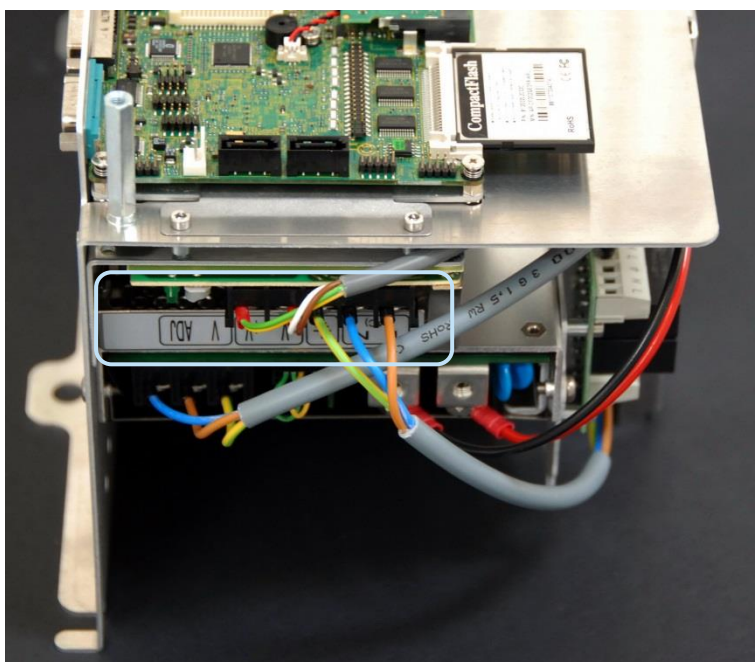
Take care of ESD handling [3.2.1 Handling ESD-sensitive parts](#)

How to replace 12V power supply in Controller box

Note: use the same procedure for power down and removing the alu cover plate and cables for teach pendant as in chapter [3.2.4 Replacement of teach pendant](#)

For replacing the 12V power supply follow exactly the same steps as for the procedure in chapter [3.2.5 Replacement of 48V power supply](#)

- The 12V power supply is placed in top of rack. The screws holding it in the frame are placed on the sides.



- Replace 12V power supply with new.
- Reconnect the wires for the 12V power supply.
- Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.
- Carefully put back the grey alu cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

3.2.7 Replacement of current distributor

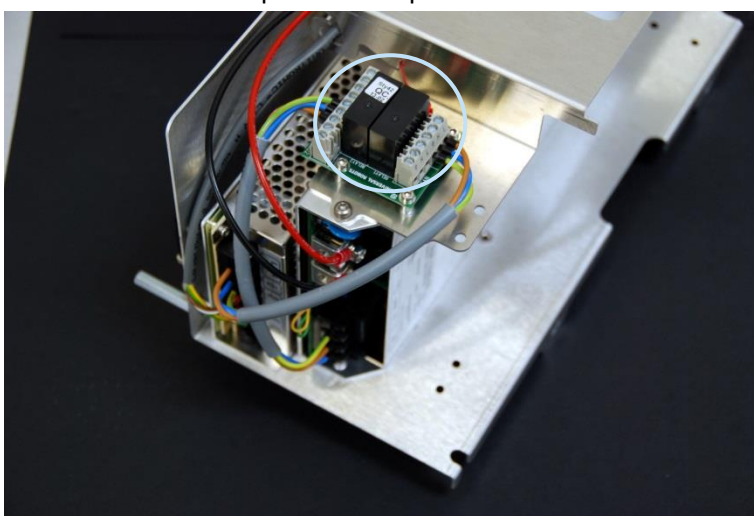
Take care of ESD handling [3.2.1 Handling ESD-sensitive parts](#)

How to replace current distributor in Controller box

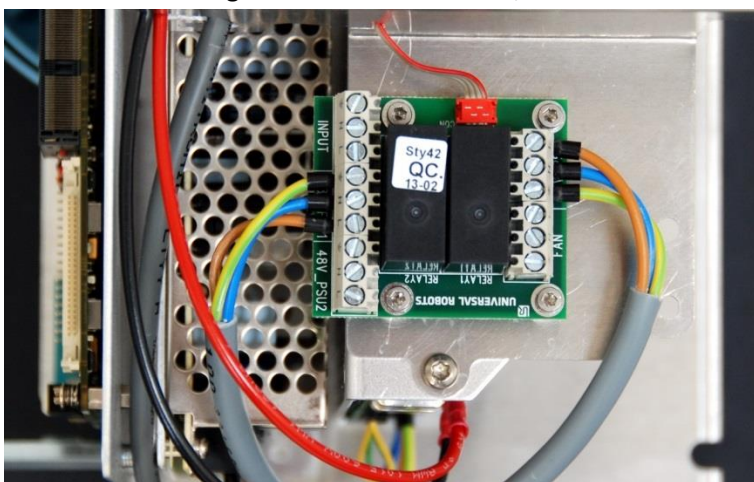
Note: use the same procedure for power down and removing the alu cover plate and cables for teach pendant as in chapter [3.2.4 Replacement of teach pendant](#)

For replacing the current distributor follow exactly the same steps as for the procedure in chapter [3.2.5 Replacement of 48V power supply](#)

- Current distributor is placed on top of rack.



- Before dismantling the current distributor, mark and disconnect the cables from the circuit board.



- Replace current distributor with new.
- Reconnect the wires for the current distributor.
- Re-install Controller module in reverse order and connect the 2 wires for the fan and cables for the teach pendant.
- Carefully put back the grey alu cover plate, make sure to mount it correct and fix it with the 5 screws.
- Connect power and verify that teach pendant works properly.

4. Software

4.1 Update software

Universal Robots software is named PolyScope.

This software can be updated, when new releases of software become available.

When updating software on robot with older version, it is required to install each update in sequence.

If it ain't broken, don't fix it:

If a robot is operating in an existing application, Universal Robots do not recommend updating software, unless the use of new functions in a newer software release is required for this application.

IMPORTANT NOTICE:

- Software should *only* be updated after consulting Distributor from where the robot has been purchased or if representing a Distributor after consulting Universal Robots.
- Universal Robots do *not* recommend updating software without proper instruction in how to update software.
- When updating firmware it is strictly forbidden to turn off controller during update.
- Universal Robots can be no means be held responsible for any failed update caused by improper operation.

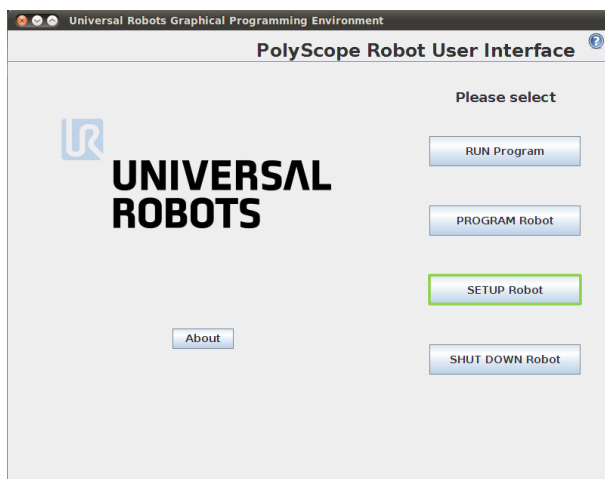
Go to www.support.universal-robots.com/download for downloading software updates.

Login is required, only applicable for Distributors.

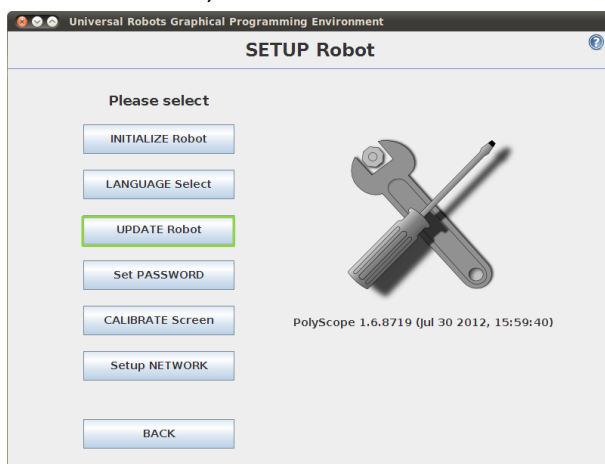
Please note: If representing an end customer, contact the Distributor from where the robot has been purchased for requesting software updates.

Instruction for updating software

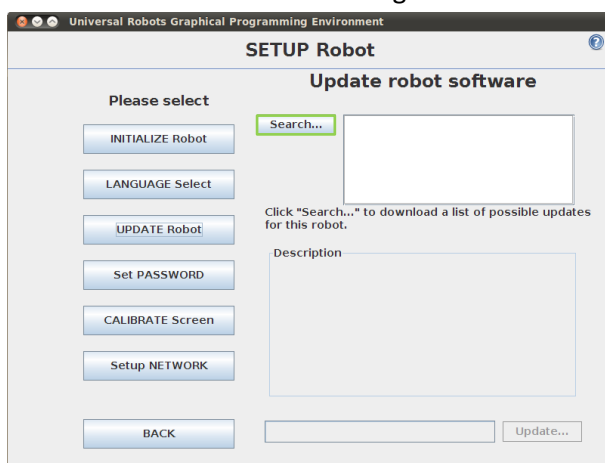
- Download software update. Carefully read requirements on support site relating to which software must be installed on robot prior to updating to the downloaded version.
- Save it in the root folder on a USB-stick.
- Insert USB-stick into USB-connector on right-hand side of teach pendant.
- Go to main screen of PolyScope.



- Press button *SETUP Robot*.
- In left side menu, select *UPDATE Robot*.



- Press button *Search* for searching after software update on USB-stick.



- Mark the found software update and press *UPDATE*.
- Press YES for updating the software.
- Await robot update software, after successful update controller will automatically shut power off.
- Remove USB-stick and boot robot.

4.2 Update joint firmware

Each joint on robot arm is provided with firmware for controlling the joint.

For normal operation firmware update is not required. Software can be updated on robot without updating the firmware.

IMPORTANT NOTICE:

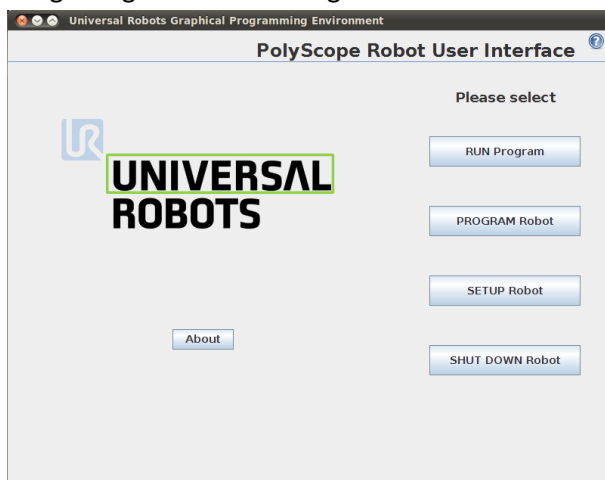
- Firmware should *only* be updated after consulting Distributor from where the robot has been purchased or if representing a Distributor after consulting Universal Robots.
- Universal Robots do *not* recommend updating firmware without proper instruction in how to update firmware.
- When updating firmware it is strictly forbidden to turn off controller or to remove cable between controller and robot arm during update.
- Universal Robots can be no means be held responsible for any failed update caused by improper operation.

Instruction for updating firmware

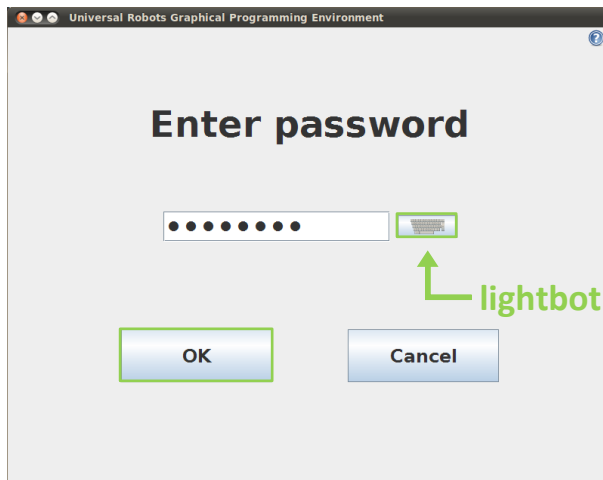
Prior to updating firmware, it is required to update the robot software.

Please refer to chapter 4.2 for updating software. When updating robot software, the firmware will automatically be copied to a folder on the controller.

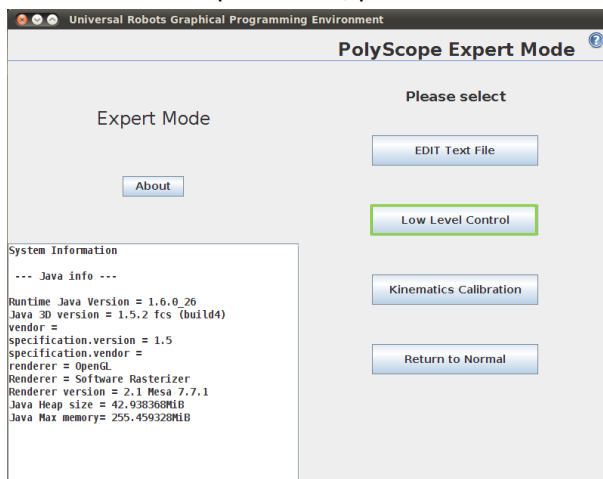
- Drag a finger from left to right across the *UNIVERSAL*-sign on main screen of PolyScope.



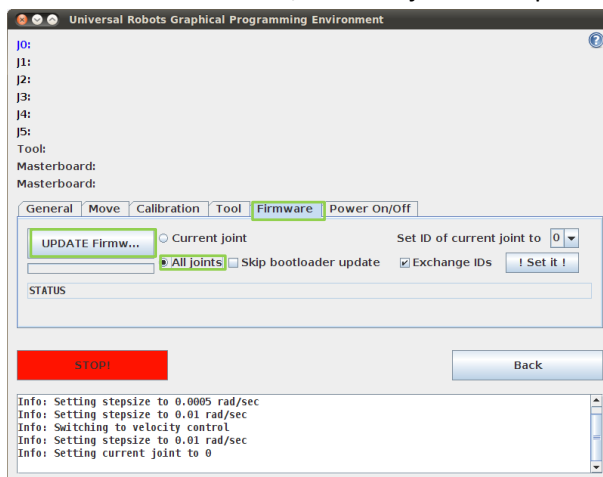
- Enter password *lightbot* and press *OK*.



- You are now in *Expert Mode*, press *Low Level Control*.

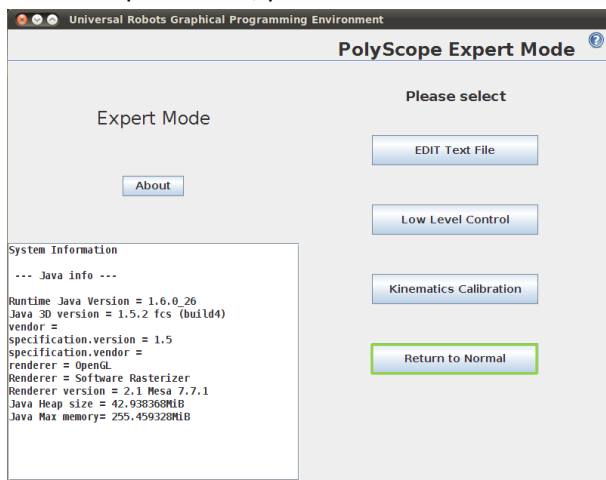


- Select the *Firmware* tab, mark *All joints* and press *UPDATE* firmware.



- Firmware update is being processed, await message that *robot firmware updated successfully*. It is strictly forbidden to turn off controller during this update.
- After successful update, press *Back*.

- Back in Expert Mode, press *Return to Normal*.



Firmware has now been updated.

4.3 Using Magic files

For easy backup, Universal Robots provides Magic files for automatic copy of data from controller to USB-stick.

These files are available:

- URmagic log file
- URmagic backup programs
- URmagic configuration files
- URmagic upload programs
- URmagic screenshot

Function:

copies the entire log history file to USB-stick
copies all programs and installation files to USB-stick
copies all configuration files to USB-stick
copies all programs and installation files *from* USB-stick
generates a screenshot of GUI when USB-stick is inserted

Go to www.support.universal-robots.com/download for downloading Magic files.

Login is required, only applicable for Distributors.

Please note: If representing an end customer, contact the Distributor from where the robot has been purchased for requiring Magic files.

Instruction for using Magic files

- Download Magic file.
- Save it in the root folder on a USB-stick.
- Insert USB-stick into USB-connector on right-hand side of teach pendant.
- After a few seconds a red **! USB !** -sign will appear on the screen, this is a warning not to remove the USB-stick, while the file will do its magic.
- Await a green **<- USB** -sign appears on the screen, then you can safely remove the USB-stick.
- Remove USB-stick and you're done.

The Magic file creates a folder on USB-stick named after the serial number of robot.

If more than one magic file is on USB-stick, they will be run in sequence, the warnings will then appear for each file. Do not remove the USB-stick before after the last file has been run. Multiple folders will be created and named after serial number added with a sequential no, like 201220xxx4_0, 201220xxx4_1 etc.

5. Troubleshooting

5.1 Error codes

| Code | Error description | Explanation | How to fix |
|-----------|--|--|---|
| CODE_0 | No error | | |
| CODE_1 | Outbuffer overflow error | | |
| CODE_1A1 | Buffer of stored warnings overflowed | | |
| CODE_1A2 | Outbuffer to RS485 overflowed (problem with PCs message) | | |
| CODE_2 | Inbuffer overflow error | | |
| CODE_3 | Processor overloaded error | | |
| CODE_4 | Broken communication | | |
| CODE_4A1 | Communication with PC lost. | | |
| CODE_4A2 | Communication with Safety Control Board A uP lost | | |
| CODE_4A3 | Communication with Safety Control Board B uP lost | | |
| CODE_4A4 | Communication with primary Teach Pendant uP lost | | |
| CODE_4A5 | Communication with secondary Teach Pendant uP lost | | |
| CODE_4A6 | Communication with primary EUROMAP67 uP lost | | |
| CODE_4A7 | Communication with secondary EUROMAP67 uP lost | | |
| CODE_4A8 | Primary EUROMAP67 uP present, but euromap67 is disabled | Incorrect safety configuration | Update the miscellaneous settings in the Safety Configuration |
| CODE_4A9 | Secondary EUROMAP67 uP present, but euromap67 is disabled | Incorrect safety configuration | Update the miscellaneous settings in the Safety Configuration |
| CODE_4A10 | Primary Teach Pendant present, but Teach Pendant safety is disabled | Incorrect safety configuration | Update the miscellaneous settings in the Safety Configuration |
| CODE_4A11 | Secondary Teach Pendant uP present, Teach Pendant safety is disabled | Incorrect safety configuration | Update the miscellaneous settings in the Safety Configuration |
| CODE_4A12 | Communication with joint 0 lost | Serial communication problem with one or more joints | |
| CODE_4A13 | Communication with joint 1 lost | Serial communication | |

| | | |
|------------------|---|--|
| | | problem with one or more joints |
| CODE_4A14 | Communication with joint 2 lost | Serial communication problem with one or more joints |
| CODE_4A15 | Communication with joint 3 lost | Serial communication problem with one or more joints |
| CODE_4A16 | Communication with joint 4 lost | Serial communication problem with one or more joints |
| CODE_4A17 | Communication with joint 5 lost | Serial communication problem with one or more joints |
| CODE_4A18 | Communication with tool lost | Serial communication problem with one or more joints |
| CODE_4A65 | Lost package from Primary Teach Pendant | |
| CODE_4A66 | Lost package from Secondary Teach Pendant | |
| CODE_4A67 | Lost package from Primary Euromap67 | |
| CODE_4A68 | Lost package from Secondary Euromap67 | |
| CODE_4A69 | Lost package from Secondary Masterboard | |
| CODE_4A70 | Lost package from joint 0 | Serial communication problem with one or more joints |
| CODE_4A71 | Lost package from joint 1 | Serial communication problem with one or more joints |
| CODE_4A72 | Lost package from joint 2 | Serial communication problem with one or more joints |
| CODE_4A73 | Lost package from joint 3 | Serial communication problem with one or more joints |
| CODE_4A74 | Lost package from joint 4 | Serial communication problem with one or more joints |
| CODE_4A75 | Lost package from joint 5 | Serial communication problem with one or more joints |

| | | | |
|--------------------|---|--|---|
| CODE_4A76 | Lost package from tool | Serial communication problem with one or more joints | |
| CODE_4A77 | Lost package from uPA to joints | | |
| CODE_4A78 | Lost package from uPA to teach pendant | | |
| CODE_4A79 | Lost package from uPA to uPB | | |
| CODE_4A80 | Lost package from uPB | | |
| CODE_4A81 | Packet counter disagreement in packet from Primary Screen | | |
| CODE_4A82 | Packet counter disagreement in packet from Secondary Screen | | |
| CODE_4A83 | Packet counter disagreement in packet from Primary Euromap67 | | |
| CODE_4A84 | Packet counter disagreement in packet from Secondary Euromap67 | | |
| CODE_4A85 | Packet counter disagreement in packet from Safety Control Board B | | |
| CODE_4A86 | Packet counter disagreement in packet from joint 0 | | |
| CODE_4A87 | Packet counter disagreement in packet from joint 1 | | |
| CODE_4A88 | Packet counter disagreement in packet from joint 2 | | |
| CODE_4A89 | Packet counter disagreement in packet from joint 3 | | |
| CODE_4A90 | Packet counter disagreement in packet from joint 4 | | |
| CODE_4A91 | Packet counter disagreement in packet from joint 5 | | |
| CODE_4A92 | Packet counter disagreement in packet from tool | | |
| CODE_4A93 | Packet counter disagreement in packet from processor A to joints | | |
| CODE_4A94 | Packet counter disagreement in packet from processor A to B | | |
| CODE_4A95 | Packet counter disagreement in packet from processor A to Teach Pendant and EUROMAP | | |
| CODE_5 | Heavy processor load warning | | |
| CODE_10 | Broken PC communication error | | |
| CODE_10A1 | Lost packet from PC | | |
| CODE_10A101 | PC packet received too early | | |
| CODE_10A102 | Packet counter does not match | | |
| CODE_10A103 | PC is sending packets too often | | |
| CODE_11 | Bad CRC error | Serial communication problem with joint | Check green 2-wire connectors and wires in joints |

| | | | |
|--------------------|--|--|---|
| CODE_12 | Unknown message error | | |
| CODE_14 | Debug message | | |
| CODE_17 | Inbuffer overflow in package from PC | Communication error between Safety Control Board and Motherboard | Check ethernet connection between circuit boards |
| CODE_26 | Motor Encoder index drift detected | Joint mechanical problem | Replace joint |
| CODE_27 | Calibration data is invalid or does not exist, selftest is needed! | | |
| CODE_29 | Online Calibration data checksum failed | | |
| CODE_30 | Master received data from too many joints | | |
| CODE_31 | Caught wrong message (not from master) | Serial communication problem with joint | Check green 2-wire connectors and wires in joints |
| CODE_32 | Flash write verify failed | | |
| CODE_33 | Calibration flash checksum failed | | |
| CODE_34 | Program flash checksum failed | | |
| CODE_34A0 | Program flash checksum failed during bootloading | | |
| CODE_34A1 | Program flash checksum failed at runtime | | |
| CODE_35 | Joint ID is undefined | | |
| CODE_36 | Illegal bootloader command | | |
| CODE_37 | Inbuffer parse error | Serial communication problem with joint | Check green 2-wire connectors and wires in joints |
| CODE_38 | Online RAM test failed | | |
| CODE_38A1 | Data-bus test failed | | |
| CODE_38A2 | Address-bus stuck-high test failed | | |
| CODE_38A3 | Address-bus stuck-low test failed | | |
| CODE_38A4 | Address-bus shorted test failed | | |
| CODE_38A5 | Memory-cell test failed | | |
| CODE_39 | Logic and Temporal Monitoring Fault | | |
| CODE_39A1 | Max current deviation failure | | |
| CODE_39A2 | Max joint-encoder speed exceeded | | |
| CODE_39A3 | Max motor-encoder speed exceeded | | |
| CODE_39A4 | Illegal state change in joint detected | | |
| CODE_39A5 | Too fast state change in joint detected | | |
| CODE_39A6 | 5V regulator voltage too low | | |
| CODE_39A7 | 5V regulator voltage too high | | |
| CODE_39A100 | Watchpoint fault: ADC task timeout | | |
| CODE_39A101 | Watchpoint fault: Motor-Control task timeout | | |
| CODE_39A102 | Watchpoint fault: Motor-encoder task timeout | | |
| CODE_39A103 | Watchpoint fault: Joint-encoder task timeout | | |
| CODE_39A104 | Watchpoint fault: Communication task timeout | | |

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| CODE_39A105 | Watchpoint fault: RAM-test task timeout | | |
| CODE_39A106 | Watchpoint fault: CalVal-test task timeout | | |
| CODE_39A107 | Watchpoint fault: ROM-test task timeout | | |
| CODE_40 | AD-Converter hit high limit joint | EMC issue external or electronics internal | Check grounding and shielding for EMC problems |
| CODE_44 | CRC check failure on primary bus | Serial communication problem with joint or secondary bus node | Check green 2-wire connectors and wires in joints |
| CODE_44A0 | Joint 0 | | |
| CODE_44A1 | Joint 1 | | |
| CODE_44A2 | Joint 2 | | |
| CODE_44A3 | Joint 3 | | |
| CODE_44A4 | Joint 4 | | |
| CODE_44A5 | Joint 5 | | |
| CODE_44A6 | Tool | | |
| CODE_45 | AD-Converter error | | |
| CODE_46 | Loose gearbox or bad encoder mounting | Mechanical problem in gear related to encoder mounting | Replace joint |
| CODE_47 | AD-Converter hit low limit | EMC issue external or electronics internal | Check grounding and shielding for EMC problems |
| CODE_48 | Powerbus voltage drop detected. | Error on 48V powerbus | Check 48V output from PSU. Check current- distributor PCB. Replacement of 48V PSU or current- distributor is necessary |
| CODE_49 | RS485 receive warning | | |
| CODE_49A200 | Secondary RS485 bus is down | | |
| CODE_50 | Robot powerup failure | Electrical error control box | Remove all external connections to I/O- interface of Masterboard. Check for short circuit. Argument of error code specifies in details what causes the error. |
| CODE_50A1 | Voltage detected at 24V rail before startup | | |
| CODE_50A2 | Voltage present at unpowered robot | | |
| CODE_50A5 | Powersupply voltage too low | | |
| CODE_50A6 | Powersupply voltage too high | | |
| CODE_50A11 | Voltage not detected at 24V rail after startup | | |
| CODE_50A15 | Warning, waiting for SafetySYS2 | | |
| CODE_50A16 | The Teach Pendant does not respond | Loose wire or incorrect safety configuration | Check the cable or change in the Safety Configuration of the |

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| | | | Installation the miscellaneous settings |
| CODE_50A17 | The Euromap67 interface does not respond | Loose wire or incorrect safety configuration | Check the cable or change in the Safety Configuration of the Installation the miscellaneous settings |
| CODE_50A18 | Warning, waiting for SafetySYS1 | | |
| CODE_50A20 | 5V, 3V3 or ADC error (5V too high) | | |
| CODE_50A21 | 5V, 3V3 or ADC error (5V too low) | | |
| CODE_50A22 | Robot current sensor reading too high | | |
| CODE_50A23 | Robot current sensor reading too low | | |
| CODE_50A24 | 48V not present (Check internal connection) | | |
| CODE_50A25 | Robot voltage present at 48V PSU powereup | | |
| CODE_50A26 | Voltage present on unpowered 48V power supply | | |
| CODE_50A27 | 12V, 3V3 or ADC error (12V too high) | | |
| CODE_50A28 | 12V, 3V3 or ADC error (12V too low) | | |
| CODE_50A29 | Analog I/O error (-12V too high) | | |
| CODE_50A30 | Analog I/O error (-12V too low) | | |
| CODE_50A31 | The other safetySYS do not initialize | | |
| CODE_50A80 | Last CPU reset caused by Low-Power-Reset | | |
| CODE_50A81 | Last CPU reset caused by Window-Watchdog-Reset | | |
| CODE_50A82 | Last CPU reset caused by Independent-Watchdog-Reset | | |
| CODE_50A83 | Last CPU reset caused by Software-Reset | | |
| CODE_50A84 | Last CPU reset caused by External-Pin-Reset | | |
| CODE_50A85 | Last CPU reset caused by Brown-Out-Reset | | |
| CODE_50A99 | Wrong software on PCB | | |
| CODE_50A100 | Cable not connected | | |
| CODE_50A101 | Short circuit in robot detected | | |
| CODE_50A102 | Voltage rising too slowly | | |
| CODE_50A103 | Voltage failed to reach acceptable level | | |
| CODE_51 | CRC check failure on secondary bus | | |
| CODE_51A0 | Processor B | | |
| CODE_51A1 | Primary screen processor | | |
| CODE_51A2 | Secondary screen processor | | |
| CODE_51A3 | Primary E67 | | |
| CODE_51A4 | Secondary E67 | | |
| CODE_53 | IO overcurrent detected | Masterboard error | Remove all external connections to I/O-interface of Masterboard. Check for short circuit |
| CODE_53AMASTER | , max is 800mA | | |

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|--------------------|---|---------------------------|--|
| CODE_53ATO | , max is 600mA | | |
| OL | | | |
| CODE_55 | Safety system error | Safety system malfunction | Check Motherboard, Masterboard, Screenboard, Current distributor(Euromap, if installed). Bypass safety connections to I/O-interface of Masterboard |
| CODE_55A23 | Safety relay error (minus connection) | | |
| CODE_55A24 | Safety relay error (plus connection) | | |
| CODE_55A33 | Safety relay error (a relay is stuck) | | |
| CODE_55A34 | Safety relay error (relays are not on) | | |
| CODE_55A50 | Voltage present at unpowered robot | | |
| CODE_55A51 | Voltage will not disappear from robot | | |
| CODE_55A52 | 5V, 3V3 or ADC error (5V too low) | | |
| CODE_55A53 | 5V, 3V3 or ADC error (5V too high) | | |
| CODE_55A90 | Bootloader error, robot voltage too low or current too high | | |
| CODE_55A91 | Bootloader error, robot voltage too high | | |
| CODE_55A100 | Safety violation | | |
| CODE_55A101 | Safety Channel Error In Masterboard | | |
| CODE_55A102 | Safety Channel Error In Screen | | |
| CODE_55A103 | Safety Channel Error In Euromap67 Interface | | |
| CODE_55A109 | Received fault message from PC | | |
| CODE_55A110 | Safety State is changing too often | | |
| CODE_55A111 | On/Off State is changing too often | | |
| CODE_55A112 | Robot current sensors readings differ | | |
| CODE_55A120 | Robot current is too high while emergency stopped | | |
| CODE_55A121 | Robot current is too high while safeguard stopped | | |
| CODE_56 | Overvoltage shutdown | Voltage exceeded 55V | Check Energy Eaters. Replace Energy Eater |
| CODE_57 | Brake release failure | | |
| CODE_57A1 | Joint did not move or motor encoder is not functioning | | |
| CODE_57A2 | Large movement detected during brake release | | |
| CODE_57A3 | Robot was not able to brake release, see log for details | | |
| CODE_58 | Motor encoder not calibrated | | |
| CODE_59 | Overcurrent shutdown | Overcurrent in joint | Check for short circuit. Check program for singularity issues. Replace joint if necessary |
| CODE_62 | Joint temperature | | |

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| CODE_62A1 | High (80 C) | | |
| CODE_62A3 | Static load too high warning | | |
| CODE_62A11 | Shut down (85 C) | | |
| CODE_62A13 | Static load too high | | |
| CODE_63 | Selftest failed | | |
| CODE_68 | SPI error | | |
| CODE_70 | Close to gearbox shear limit | Acceleration / deceleration to high. Mechanical problem in gear related to encoder mounting | Reduce acceleration in user program. Replace joint if necessary |
| CODE_71 | Startup check error | | |
| CODE_71A1 | Hardware is size1, software is not | | |
| CODE_71A2 | Hardware is size2, software is not | | |
| CODE_71A3 | Hardware is size3, software is not | | |
| CODE_71A4 | Hardware is size4, software is not | | |
| CODE_71A5 | Invalid hardware size read | | |
| CODE_71A6 | Motor indication signal not working | | |
| CODE_71A7 | Phase 1 and phase 2 not working | | |
| CODE_71A8 | Phase 2 not working | | |
| CODE_71A9 | Phase 1 not working | | |
| CODE_71A10 | Invalid motor test result | | |
| CODE_71A11 | ADC calibration failed | | |
| CODE_72 | Power Supply Unit failure | | |
| CODE_72A1 | 0 PSUs are active | PSU was not able to deliver 48V | Check power connection between power supply and Safety Control Board |
| CODE_72A2 | 1 PSU active, but we expect 2 (UR10) | PSU was not able to deliver 48V or UR10 flash card in UR5 robot | Check power connection between power supply and Safety Control Board and check that the flash card and robot match |
| CODE_72A3 | 2 PSUs active, but we expect 1 (UR5) | UR5 flash card in UR10 robot | Check that the flash card and robot match |
| CODE_73 | Brake test failed during selftest, check brakepin | | |
| CODE_74 | Joint encoder warning | | |
| CODE_74A2 | Speed reading is not valid | | |
| CODE_74A8 | Supply voltage is out of range | | |
| CODE_74A16 | Temperature is out of range | | |
| CODE_74A64 | Signal low =Too far from magnetic ring | | |
| CODE_74A128 | Signal saturation =Too close to magnetic ring | | |
| CODE_75 | Joint encoder error | | |
| CODE_75A1 | Invalid decode: Readhead misalignment, ring damaged or external magnetic field present. | | |

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|-------------------|---|--|--|
| CODE_75A4 | System error=malfunction or inconsistent calibration detected | | |
| CODE_75A32 | Signal lost =Misaligned readhead or damaged ring | | |
| CODE_76 | Joint encoder communication CRC error | | |
| CODE_100 | Robot changed mode | Status warning, general modus change | Check preceding errors in log history |
| CODE_101 | Real Robot Connected | | |
| CODE_102 | Real Robot not connected - Simulating Robot | | |
| CODE_103 | UR Ethernet Error | | |
| CODE_103A1 | 3 packages in a row lost from Safety Control Board | | |
| CODE_104 | Error=Empty command sent to robot | | |
| CODE_111 | Something is pulling the robot | | |
| CODE_116 | Realtime part warning | Possible CPU-overload due to structure of user program | Restructure user program |
| CODE_117 | Restart SCB failed | The Safety Control Board couldn't be rebooted from the controller. | Reboot the robot |
| CODE_150 | Protective Stop: Position close to joint limits | | |
| CODE_151 | Protective Stop: Tool orientation close to limits | | |
| CODE_152 | Protective Stop: Position close to safety plane limits | | |
| CODE_153 | Protective Stop: Position deviates from path | | |
| CODE_154 | Protective Stop: Position in singularity | Robot can not move linear in a singularity | Use jointspace movement or change the motion |
| CODE_155 | Protective Stop: Robot cannot maintain its position, check if payload is correct | | |
| CODE_156 | Protective Stop: Wrong payload or mounting detected, or something is pushing the robot when entering Teach mode | The robot may move unexpected due to wrong settings | Verify that the TCP configuration and mounting in the used installation is correct |
| CODE_172 | Illegal control mode | | |
| CODE_184 | Joint self test not completed | | |
| CODE_191 | Safety system violation | | |
| CODE_191A1 | Joint position limit violated | | |
| CODE_191A2 | Joint speed limit violated | | |
| CODE_191A3 | TCP speed limit violated | | |
| CODE_191A4 | TCP position limit violated | | |
| CODE_191A5 | TCP orientation limit violated | | |
| CODE_191A6 | Power limit violated | | |
| CODE_191A7 | Joint torque window violated | | |
| CODE_191A8 | Joint torque window too large | | |

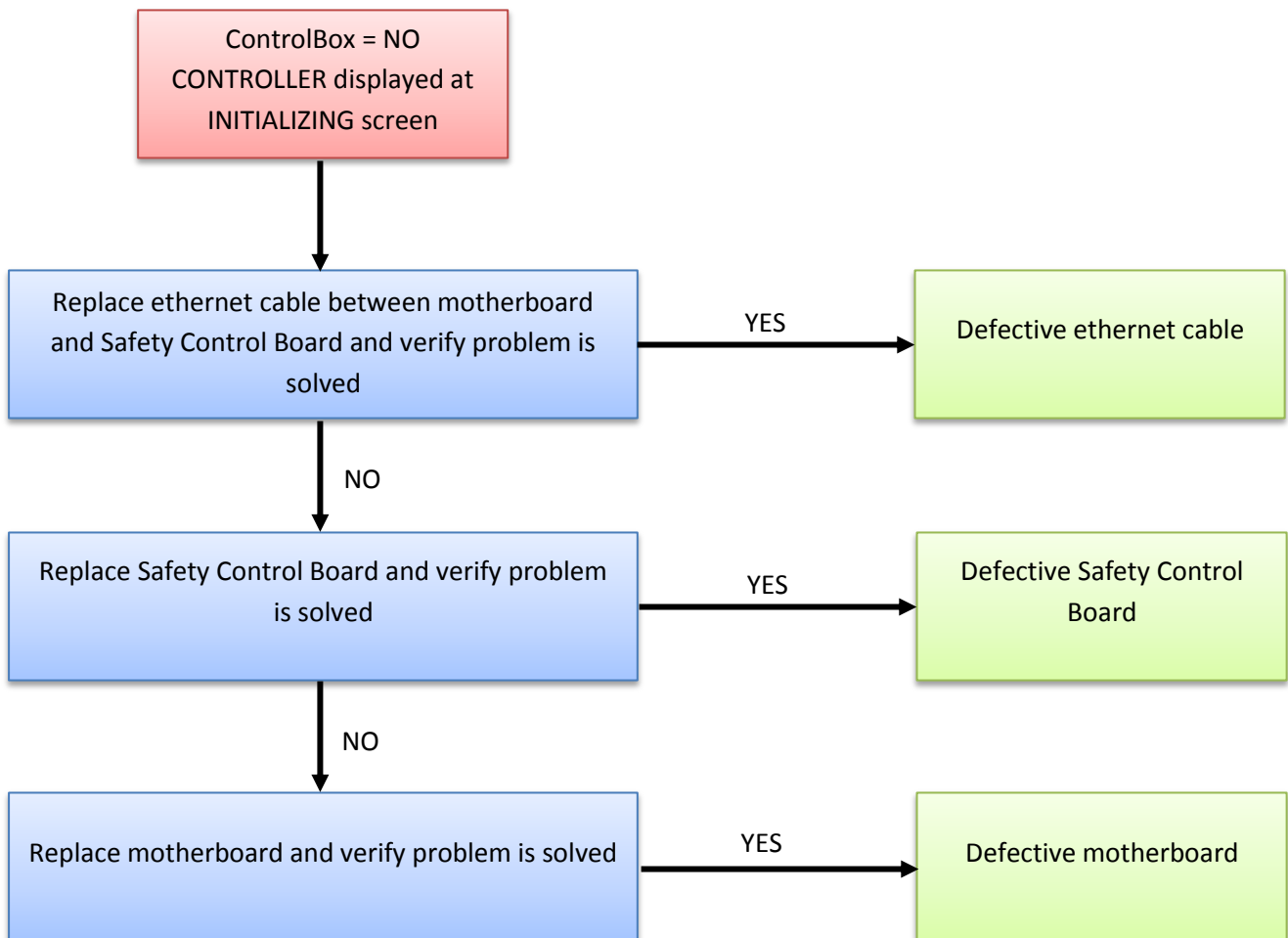
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| CODE_191A9 | Reduced mode output violation |
| CODE_191A10 | Safeguard stop output violation |
| CODE_191A11 | Emergency stop output violation |
| CODE_191A12 | Momentum limit violation |
| CODE_191A13 | Robot moving output violation |
| CODE_191A14 | Robot is not braking in stop mode |
| CODE_191A15 | Robot is moving in stop mode |
| CODE_191A16 | Robot did not stop in time |
| CODE_191A17 | Received a null vector for TCP orientation |
| CODE_191A18 | Robot not stopping output violation |
| CODE_191A19 | Invalid safety IO configuration |
| CODE_191A20 | Configuration information or limit sets not received |
| CODE_191A21 | The other safety processor detected a violation |
| CODE_191A22 | Received unknown command from PC |
| CODE_191A23 | Invalid setup of safety limits |
| CODE_191A24 | Reduced Mode Output set, while it should not be |
| CODE_191A25 | Reduced Mode Output not set, while it should be |
| CODE_191A26 | Not Reduced Mode Output set, while it should not be |
| CODE_191A27 | Not Reduced Mode Output not set, while it should be |
| CODE_191A28 | Robot Emergency Stop exceeded maximum stop time |
| CODE_191A29 | System Emergency Stop exceeded maximum stop time |
| CODE_191A30 | Safeguard Stop exceeded maximum stop time |
| CODE_192 | Safety system fault |
| CODE_192A1 | Robot still powered in emergency stop |
| CODE_192A2 | Robot emergency stop disagreement |
| CODE_192A3 | System emergency stop disagreement |
| CODE_192A4 | Safeguard stop disagreement |
| CODE_192A5 | Euromap safeguard stop disagreement |
| CODE_192A6 | Joint position disagreement |
| CODE_192A7 | Joint speed disagreement |
| CODE_192A8 | Joint torque disagreement |
| CODE_192A9 | TCP speed disagreement |
| CODE_192A10 | TCP position disagreement |
| CODE_192A11 | TCP orientation disagreement |
| CODE_192A12 | Power disagreement |
| CODE_192A13 | Joint torque window disagreement |
| CODE_192A14 | Reduced mode input disagreement |
| CODE_192A15 | Reduced mode output disagreement |
| CODE_192A16 | Safety output failed |

| | |
|--------------------|---|
| CODE_192A17 | Safeguard stop output disagreement |
| CODE_192A18 | The other safety processor is in fault |
| CODE_192A19 | Emergency stop output disagreement |
| CODE_192A20 | SPI output error detected |
| CODE_192A21 | Momentum disagreement |
| CODE_192A22 | Robot moving output disagreement |
| CODE_192A23 | Wrong processor ID |
| CODE_192A24 | Wrong processor revision |
| CODE_192A25 | Potential brownout detected |
| CODE_192A26 | Emergency stop output disagreement |
| CODE_192A27 | Safeguard stop output disagreement |
| CODE_192A28 | Robot not stopping output disagreement |
| CODE_192A29 | Safeguard reset input disagreement |
| CODE_192A30 | Safety processor booted up in fault mode |
| CODE_192A31 | Reduced Mode Output disagreement |
| CODE_192A32 | Not Reduced Mode Output disagreement |
| CODE_192A33 | Checksum disagreement between uA and uB |
| CODE_192A34 | User safety config checksum disagreement between uA and GUI |
| CODE_192A35 | Robot config checksum disagreement between uA and GUI |
| CODE_192A36 | Online RAM test failed |
| CODE_192A37 | Not all safety related functionalities are running |
| CODE_193 | One of the nodes is in fault mode |
| CODE_193A0 | Joint 0 |
| CODE_193A1 | Joint 1 |
| CODE_193A2 | Joint 2 |
| CODE_193A3 | Joint 3 |
| CODE_193A4 | Joint 4 |
| CODE_193A5 | Joint 5 |
| CODE_193A6 | Tool |
| CODE_193A7 | Screen 1 |
| CODE_193A8 | Screen 2 |
| CODE_193A9 | Euromap 1 |
| CODE_193A10 | Euromap 2 |
| CODE_194 | One of the nodes is not booted or not present |
| CODE_194A0 | Joint 0 |
| CODE_194A1 | Joint 1 |
| CODE_194A2 | Joint 2 |
| CODE_194A3 | Joint 3 |
| CODE_194A4 | Joint 4 |
| CODE_194A5 | Joint 5 |
| CODE_194A6 | Tool |
| CODE_194A7 | Screen 1 |

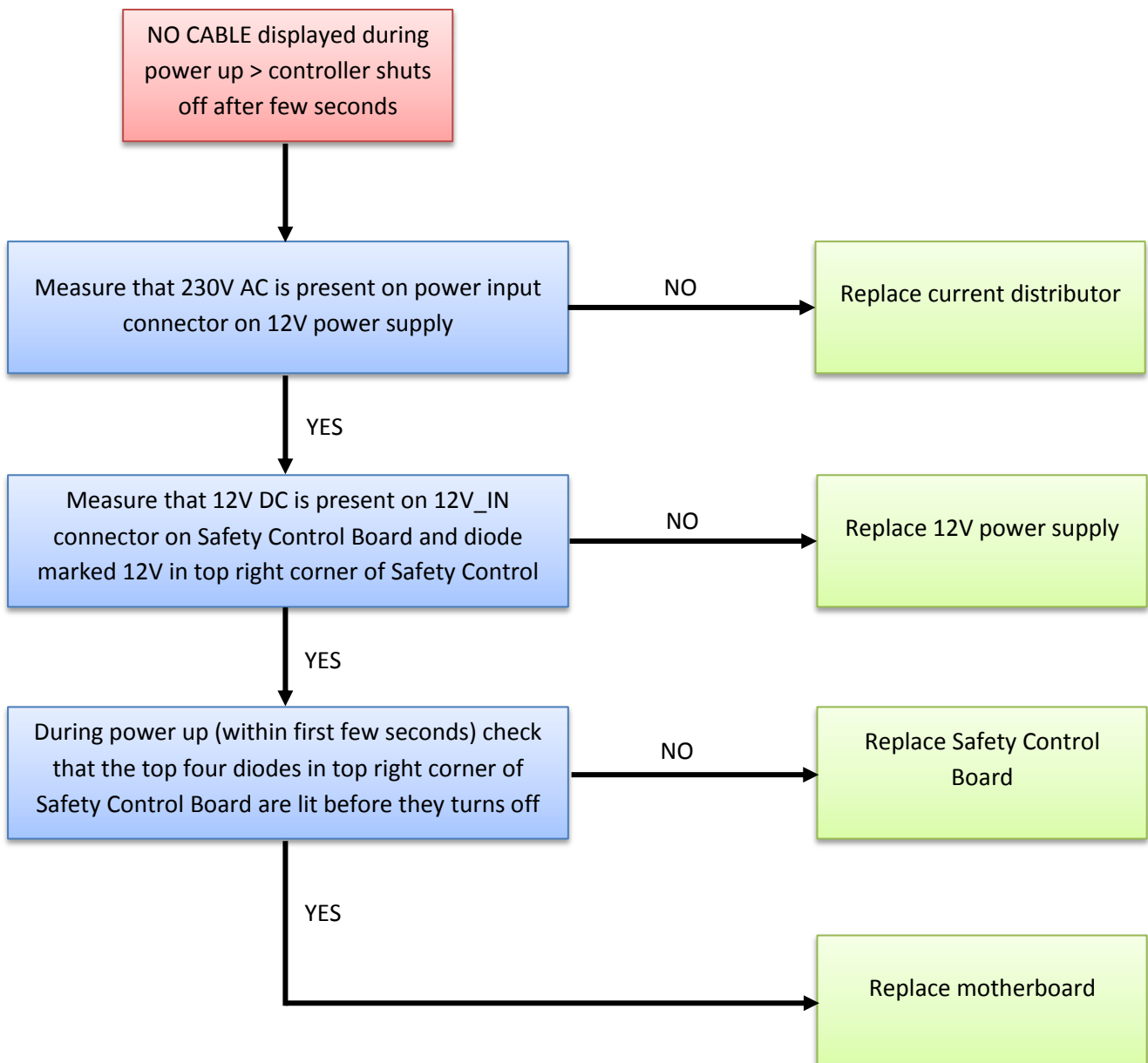
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| CODE_194A8 | Screen 2 | | |
| CODE_194A9 | Euromap 1 | | |
| CODE_194A10 | Euromap 2 | | |
| CODE_195 | Conveyor speed too high | Conveyor speed higher than robot is able to run | Make sure that conveyor tracking is set correct up |
| CODE_196 | MoveP speed too high | Too high speed in relation to blend radius | Reduce speed or increase blend radius in user program |
| CODE_197 | Blend overlap warning | | |
| CODE_200 | Safety Control Board hardware error | | |
| CODE_200A1 | Hardware ID is wrong | | |
| CODE_200A2 | MCU type is wrong | | |
| CODE_200A3 | Part ID is wrong | | |
| CODE_200A4 | RAM test failed | | |
| CODE_200A5 | Register test failed | | |
| CODE_200A6 | pRom Crc test failed | | |
| CODE_200A7 | Watchdog reset the processor | | |
| CODE_200A8 | OVG signal test not passed | | |
| CODE_200A9 | 3V3A power good pin is low | | |
| CODE_200A10 | 3V3B power good pin is low | | |
| CODE_200A11 | 5V power good is low | | |
| CODE_200A12 | 3V3 voltage too low | | |
| CODE_200A13 | 3v3 voltage too high | | |
| CODE_200A14 | 48V input is too low | | |
| CODE_200A15 | 48V input is too high | | |
| CODE_200A16 | 24V IO short circuited | | |
| CODE_200A17 | PC current is too high | | |
| CODE_200A18 | Robot voltage is too low | | |
| CODE_200A19 | Robot voltage is too high | | |
| CODE_200A20 | 24V IO voltage is too low | | |
| CODE_200A21 | 12V voltage is too high | | |
| CODE_200A22 | 12V voltage is too low | | |
| CODE_200A23 | It took too long to stabilize 24V | | |
| CODE_200A24 | It took too long to stabilize 24V IO | | |
| CODE_200A25 | 24V voltage is too high | | |
| CODE_200A26 | 24V IO voltage is too high | | |
| CODE_201 | Setup of safety board failed | Invalid safety parameters have been received | Verify that the setup of the Safety Configuration is valid |
| CODE_203 | PolyScope detected a mismatch between the shown and (to be) applied safety parameters | The PolyScope continuously verifies that the shown safety parameters are equal to the running parameters | Reload the installation |

5.2 Error phenomena

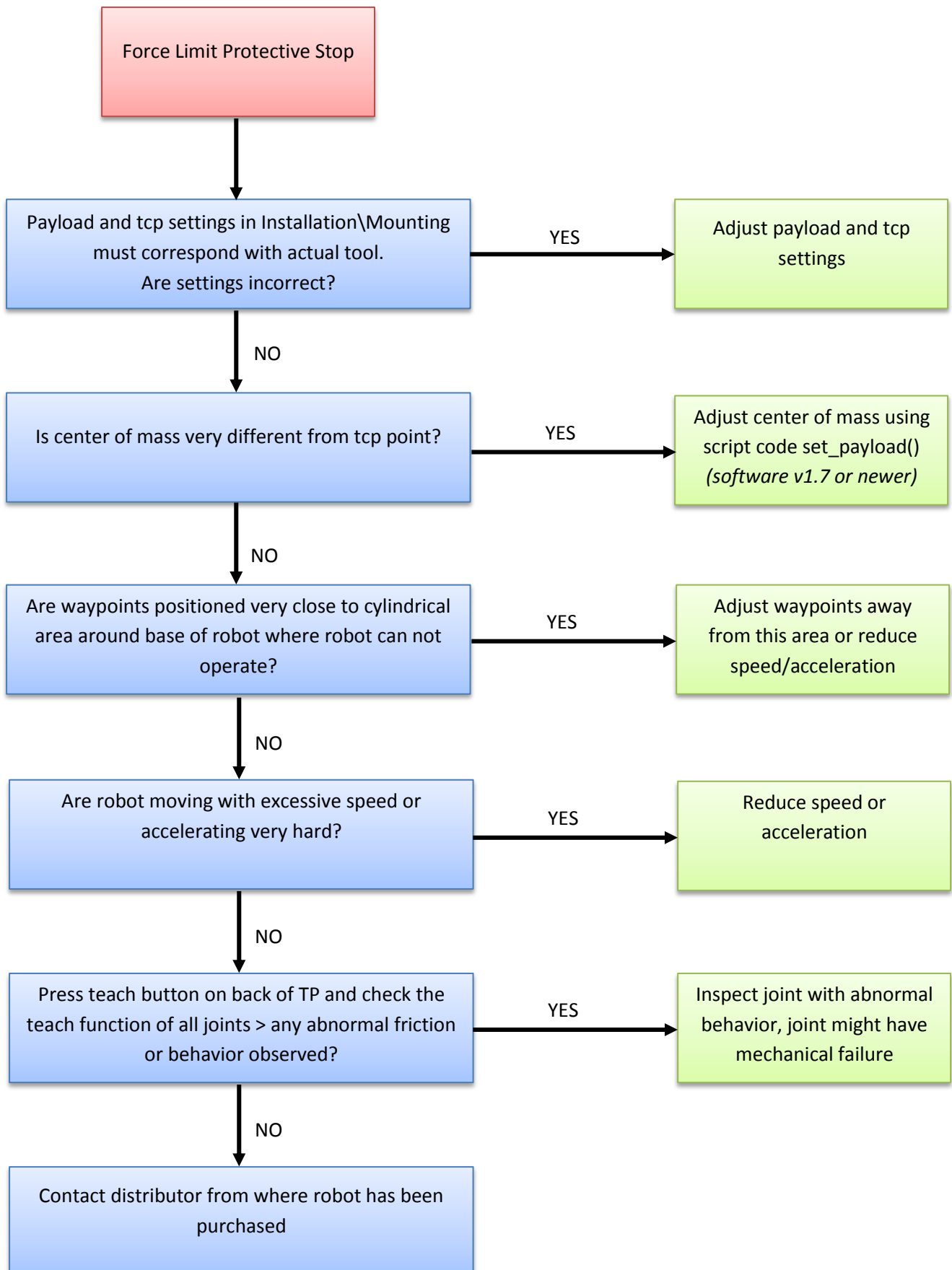
5.2.1 ControlBox: NO CONTROLLER displayed in Initializing



5.2.2 NO CABLE displayed during power up



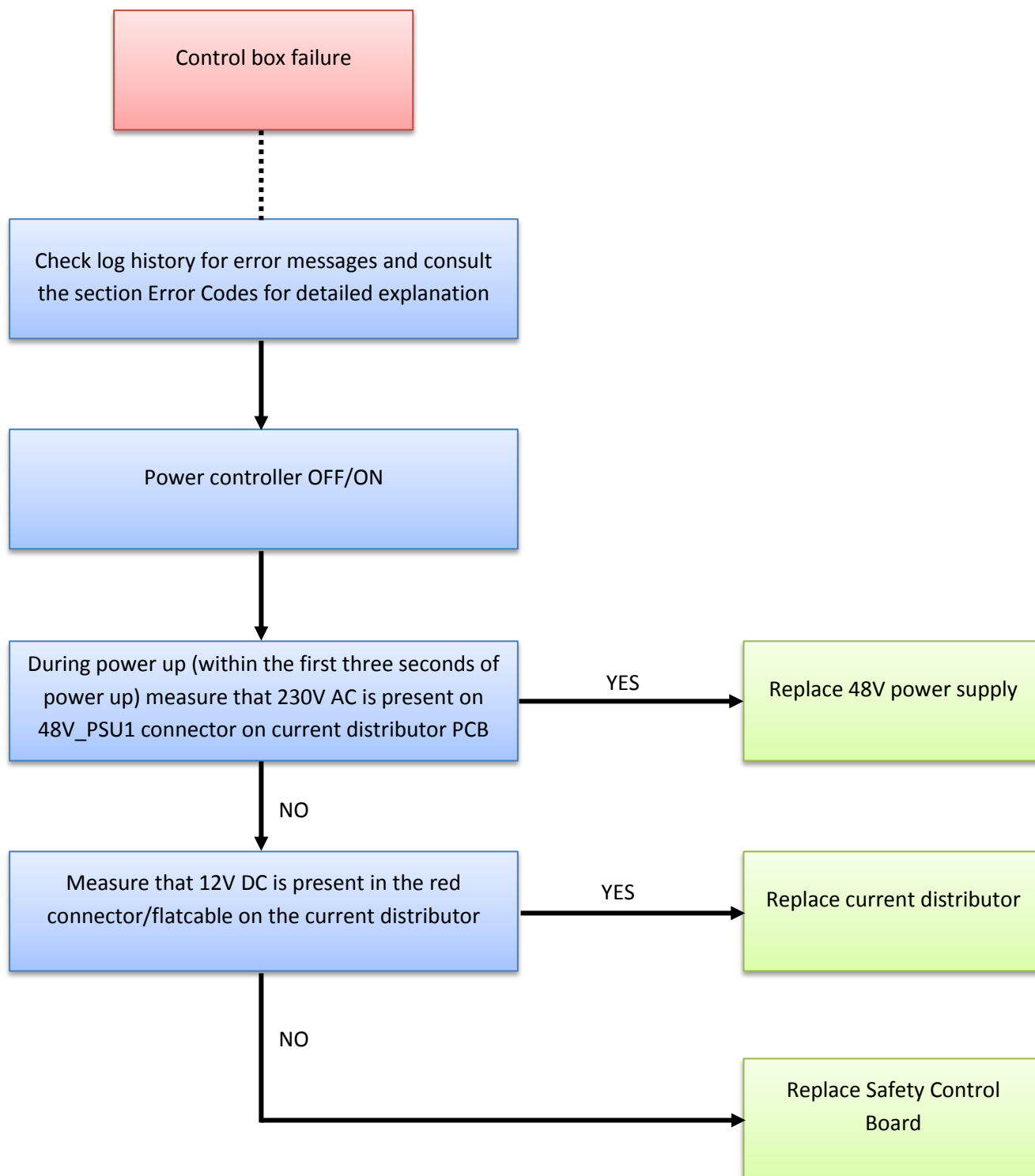
5.2.3 Force limit protective stop

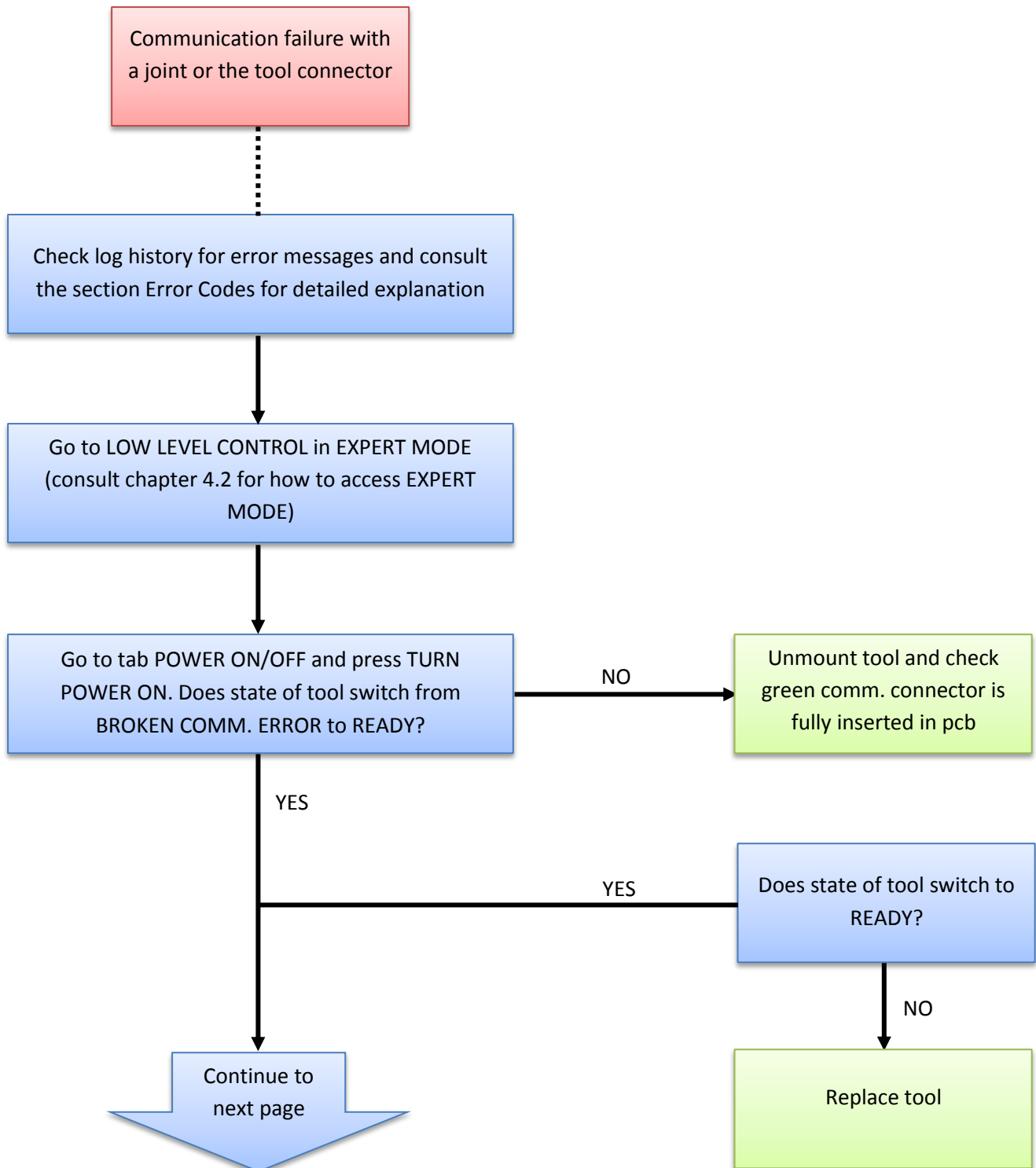


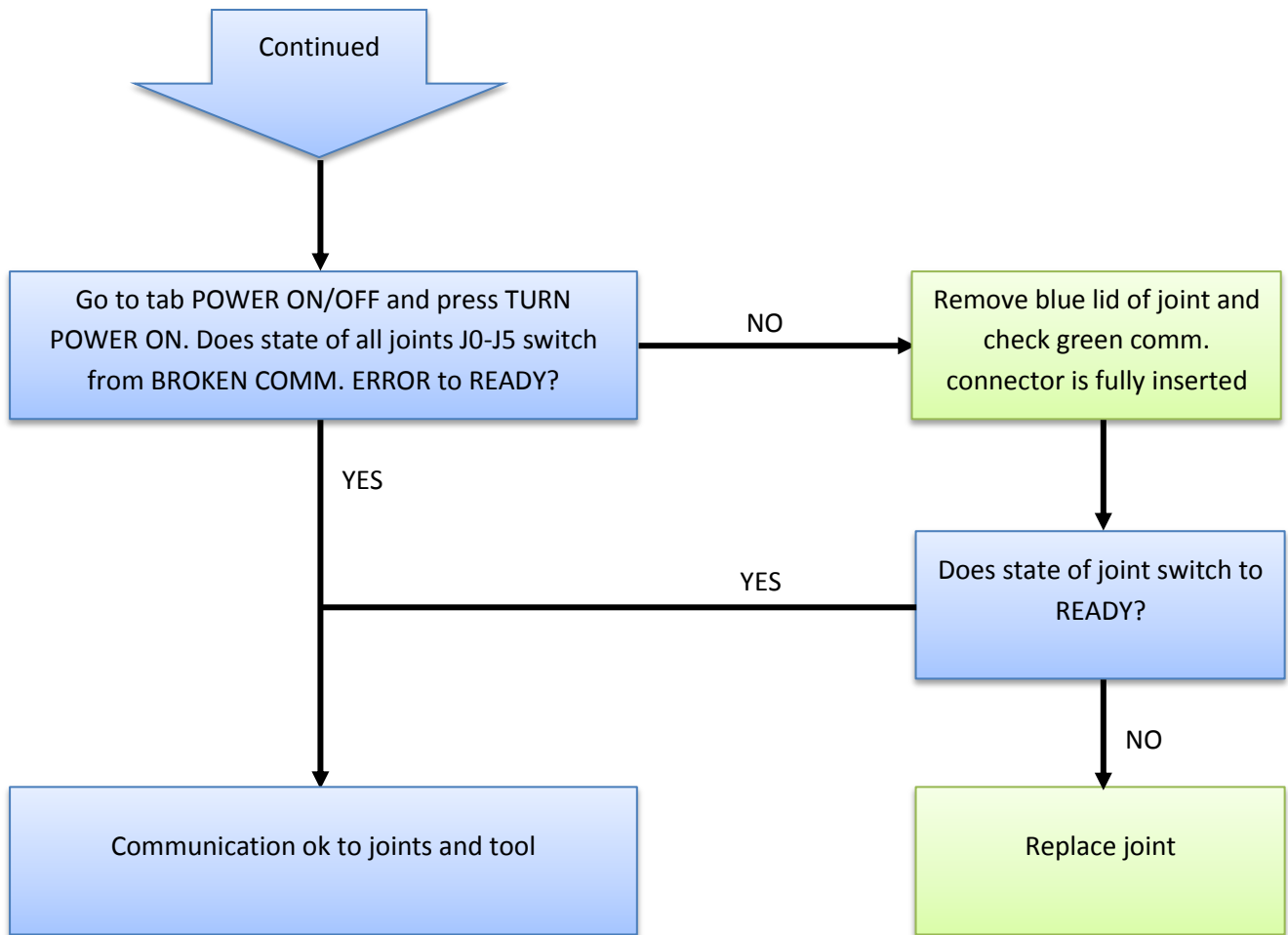
5.2.4 Power on failure in Initializing

If power turns off a few seconds after Robot Power is turned On in the Initializing window, there are many possible causes for this phenomenon.

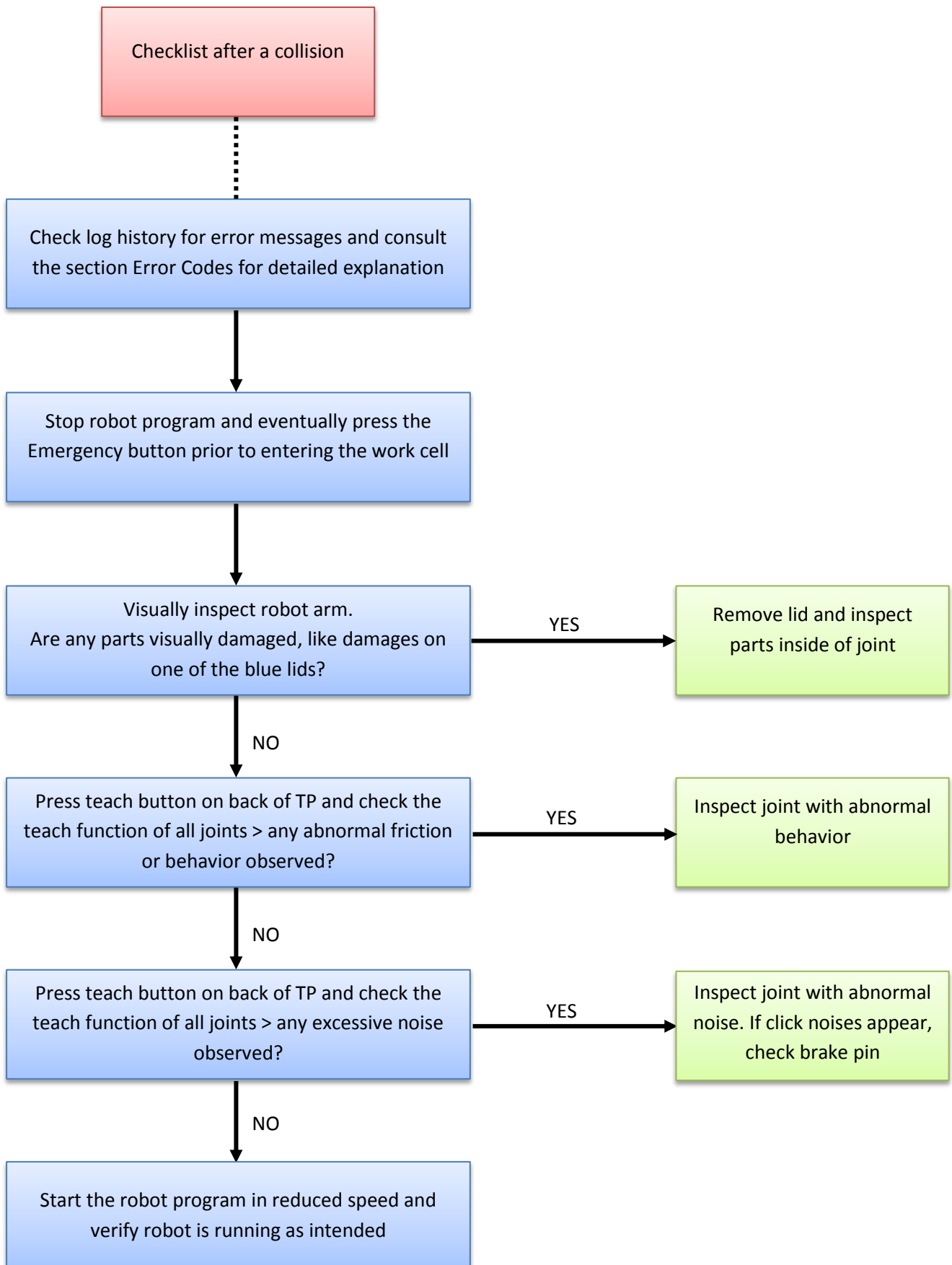
Most likely it is a control box failure or a communication failure with a joint or the tool.







5.2.5 Checklist after a collision



Servicemanual_UR5_en_rev3.0.2



6. Spare parts

6.1 Spare part list

| Item no. | Item designation |
|---------------------|---|
| Controller: | |
| 122905 | Controller incl. Teach Pendant UR5 |
| 122900 | Controller excl. Teach Pendant UR5 |
| 122091 | Teach Pendant incl. Touch Screen & power cable UR5 & UR10 |
| 171021 | Flash card |
| 122600 | Motherboard kit |
| 172290 | Safety Controlboard Kit |
| 177002 | Power Supply Unit 12V |
| 177003 | Power Supply Unit 48V |
| 172080 | Current Distributor PCB |
| 122745 | Energy-eater incl. fan |
| 164219 | Wire bundle controller output UR5 |
| 171030 | RAM module |
| 177503 | Filter kit for controller |
| Robot arm: | |
| 122050 | Base Mounting Bracket incl. Cable 6m UR5 |
| 122123 | Joint Size 3 Base UR5 |
| 122223 | Joint Size 3 Shoulder UR5 |
| 122323 | Joint Size 3 Elbow UR5 |
| 122121 | Joint Size 1 Wrist 1 UR5 |
| 122221 | Joint Size 1 Wrist 2 UR5 |
| 122321 | Joint Size 1 Wrist 3 UR5 |
| 122041 | Tool Mounting Bracket UR5 |
| 103305 | Sealing set UR5, external |
| 103405 | Lid set complete UR5 incl. seal |
| Accessories: | |
| 173100 | Cable f. tool external |
| 139033 | Bracket f. Mounting Teach Pendant |
| 132407 | Bracket f. Mounting Controller |
| 107000 | Safety Controlboard Terminal Kit |
| 131501 | Bracket f. mounting robotarm UR5 (Item profile) |
| 131502 | Bracket f. mounting robotarm UR5 (Bosch profile) |

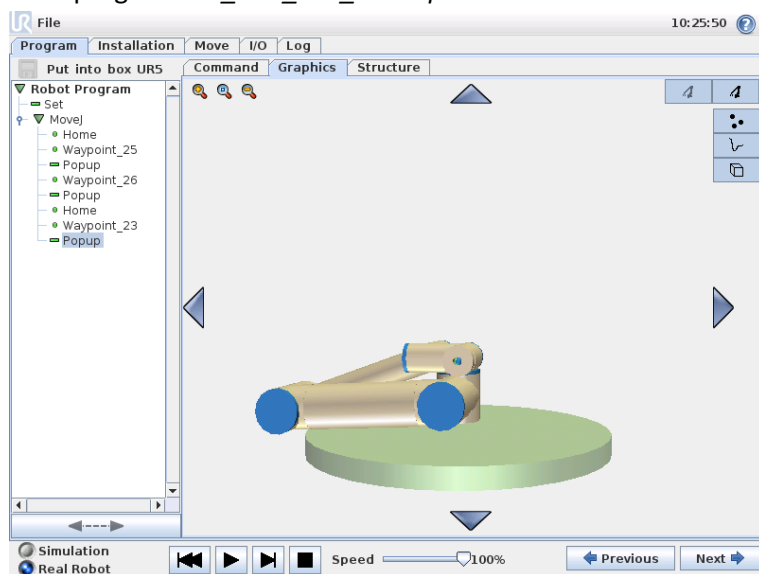
6.2 Tool part list

| Item no. | Item designation |
|----------|---|
| 109005 | Tool kit UR5 (kit includes all of the below part no.'s) |
| 109101 | Spanner Hex 5.5mm |
| 109102 | Spanner Hex 7.0mm |
| 109103 | Screwdriver torx T10 |
| 109105 | Torque wrench Hex 5.5mm Size 1 and Size 2 |
| 109106 | Torque wrench Hex 7.0mm Size 3 |
| 109108 | Calibration tool size 1 |
| 109109 | Calibration tool size 3 |
| 164084 | Bypass cable (for setting joint-ID) |
| | |

7. Packing of robot

Packing of robot and controller box for shipment

- Remove any external tooling and external electrical connections.
- Load program *Put_into_box_ur5.urp* and follow instructions while removing mounting bolts.



While robot folds together, hold a piece of bubble wrap between Shoulder joint and wrists.

Note: If robot cannot run or power is not available, it is possible to manually release the brakes for each joint individually and pack the robot accordingly. For brake release, see chapter 3.1.2.

- Power down, disconnect power and disconnect robot arm from controller.
- Pack robot arm and Controller box in designated boxes.



8. Changelog

8.1 Changelog

| Date | Revision | Action | Changes |
|---------------|--------------|---------|--|
| 3. May 2014 | UR5_en_3.0 | Added | Revision 3.0 released |
| 19. June 2014 | UR5_en_3.0.1 | Changed | Pictures and illustrations changed to match 3. gen. robot |
| 29. July 2014 | UR5_en_3.0.2 | Changed | Error codes, Spareparts changed to match 3. Gen robot and ESD handling added |
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